添付資料 17 座学研修教材(給水)(英語版)

Design of Rural Water Supply System

Lesson 1 Introduction

- WB's Rural Water Supply Manuals
- Water System Design Process
- Outline of Water Supply System

RURAL WATER SUPPLY MANUALS

February 2012

The World Bank Office Manila

Volume I: DESIGN MANUAL

Volume II: CONSTRUCTION SUPERVISION MANUAL

Volume III: OPERATION AND MAINTENANCE MANUAL

RURAL WATER SYSTEM DESIGN PROCESS

1. Service Level

2. Water Demand Projections

3. Facilities Designs

4. Capital Investment and O&M Costs

5. Tariff Design

6. Design Iteration

7. Plans and Design Specifications

1. Service Level

– The decision on service level or levels that the utility would provide should be based on a consultation process among the stakeholders.

2. Water Demand Projections

– It is necessary to determine the design horizon for which the facilities will be designed, and project the population to be served annually over this horizon, the unit consumptions, and expected non-revenue water.

3. Facilities Designs

4. Capital Investment and O&M Costs

–The planner/designer will have to estimate the O&M costs based on the details of the proposed system, its water source, and facilities.

5. Tariff Design

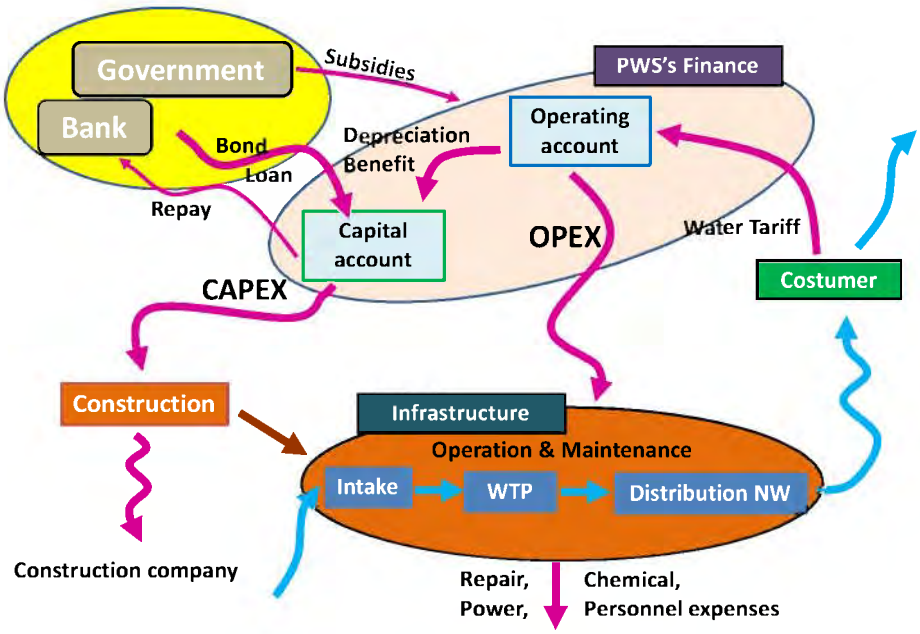
6. Design Iteration

– Before plans are finalized, there is need to confirm if the facility, as proposed, meets the social criteria of affordability and acceptance.

7. Plans and Design Specifications

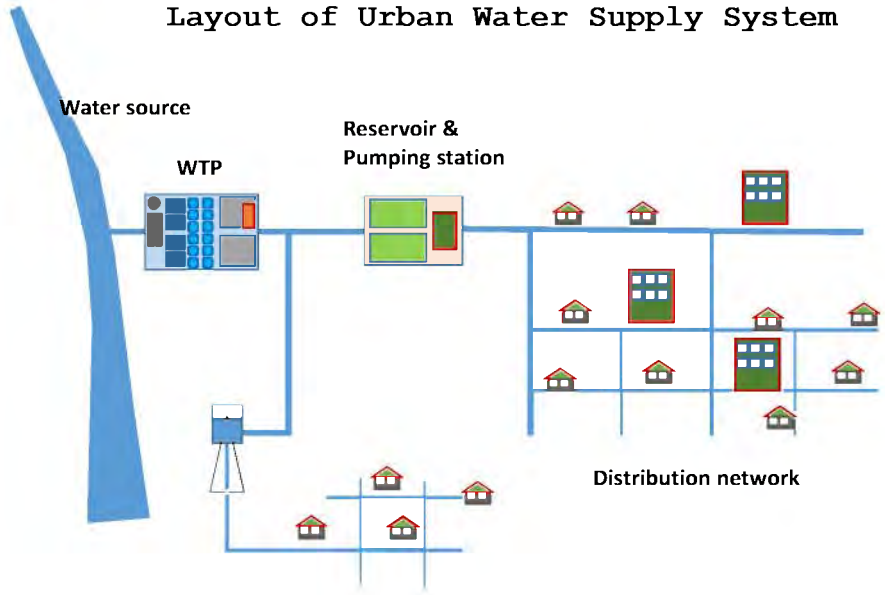
– Once all the agreements, design parameters, and assumptions are established, the detailed plans have to be prepared by professional engineers to ensure a well-balanced system that will fulfill its objectives, and to provide a detailed guide for the construction of the facilities.

Circle for Water supply Sustaining



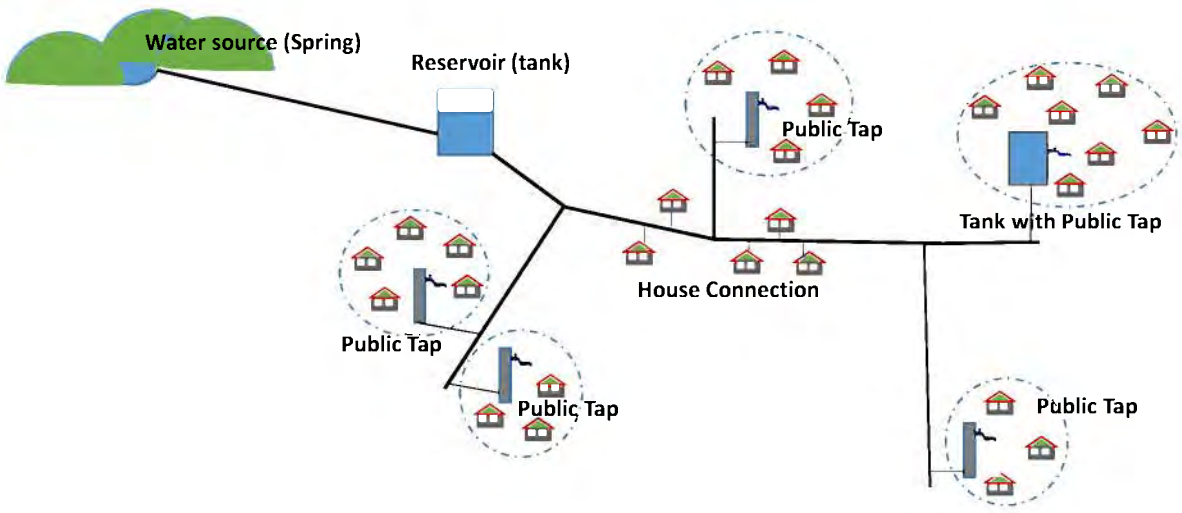
OUTLINE OF WATER SUPPLY SYSTEM

Layout of Urban Water Supply System



3. Facilities Designs

Layout of Rural Water Supply System



Component of Rural Water Supply System

1. Water source and Intake facilities
2. Transmission main
3. Water treatment plant
4. Reservoir (Tank)
5. Distribution mains
6. Public taps or (and) Service pipe

Lesson 2 Water Demand

- Service Level Definitions
- Design Period
- Design Population
- Water Consumptions
- Non-Revenue Water (NRW)
- Water Demand

1. Service Level

Per Capita Water Consumption = ?

Public Tap or House Connection ?

- Multi-tap in house

100 l/c/d

→ 50m (2.5min)

50 l/c/d

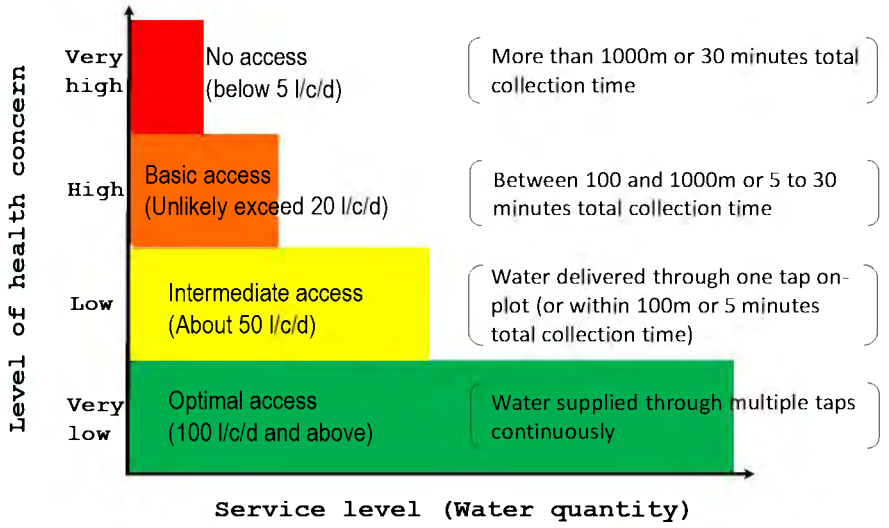
→ 50m – 500m (2.5min - 15min)

20 l/c/d

→ 500m (15min)

Below 5 l/c/d

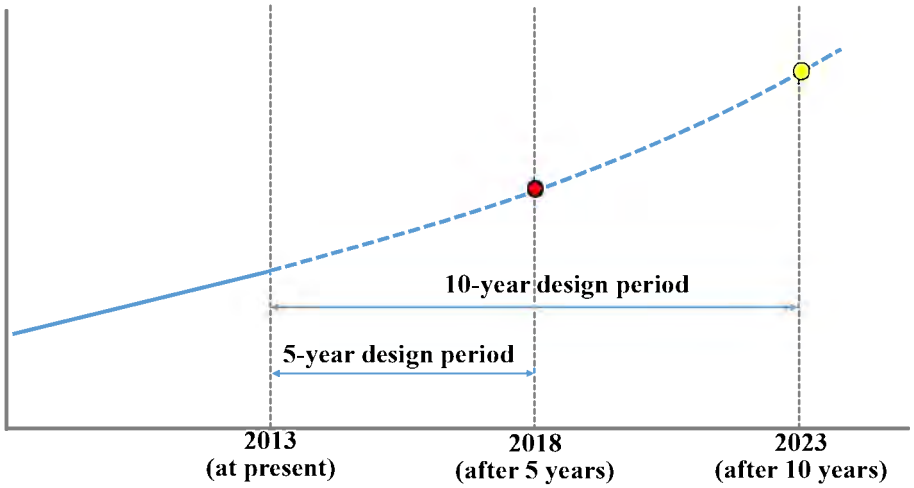
Domestic Water Quantity and Health



Summary of requirement for water service level to promote health

Service level	Access measure	*Needs met*	Level of health concern
No access (quantity collected often below 5 l/c/d)	More than 1000m or 30 minutes total collection time	Consumption – cannot be assured Hygiene – not possible (unless practiced at source)	Very high
Basic access (average quantity unlikely to exceed 20 l/c/d)	Between 100 and 1000m or 5 to 30 minutes total collection time	Consumption – should be assured Hygiene – hand washing and basic food hygiene possible; laundry/ bathing difficult to assure unless carried out at source	High
Intermediate access (average quantity about 50 l/c/d)	Water delivered through one tap on plot (or within 100m or 5 minutes total collection time	Consumption – assured Hygiene – all basic personal and food hygiene assured; laundry and bathing should also be assured	Low
Optimal access (average quantity 100 l/c/d and above)	Water supplied through multiple taps continuously	Consumption – all needs met Hygiene – all needs should be met	Very low

2. Design Period



	Advantages	Disadvantages
Five-year design period	Low initial capital cost.	Need for new capital outlays after five (5) years to upgrade system capacity.
Ten-year design period	The water system facilities are capable of meeting the demand over a longer period.	The higher initial capital cost.

3. Design Population

2 ways of projecting the design population

- Estimate the population that can be served by the sources.
- Project the community population, and determine the potential service area4 and the served population.

$$CP\ (2023) = CP\ (2013)\ \times\ (1+ r)^n$$

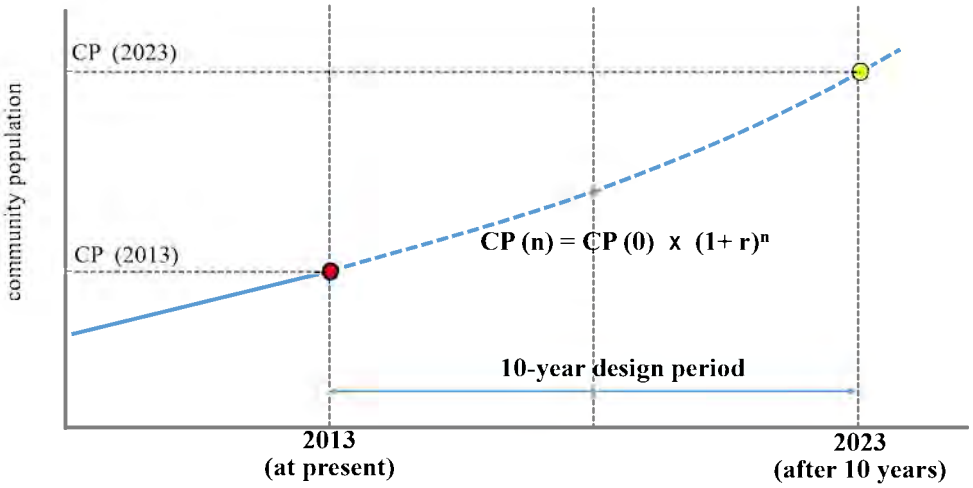
herein

CP (2023) = projected Community Population at 2023

CP (2013) = Community Population at present (2013)

r = yearly growth rate

n = design period (here 10years)



4. Water consumption

In rural areas:
Water consumption is generally limited to domestic uses.

- **drinking**
- **cooking**
- **cleaning**
- **washing**
- **bathing**

} **30 - 60 lpcd**

Institutional Connections: 1.0 m3/d
Commercial Connections: 0.8 m3/d

5. Non Revenue Water (NRW)

$$\text{NRW (\%)} = \frac{\text{Amount of NRW}}{\text{System input volume}} \text{ X } 100\ (\%)$$

NRW
Leakage
Illegal use

System input volume
Amount of produced water or distributed water

6. Water Demand

Water demand:
Summation of all the consumptions to determine the capacity needed from the source/s.

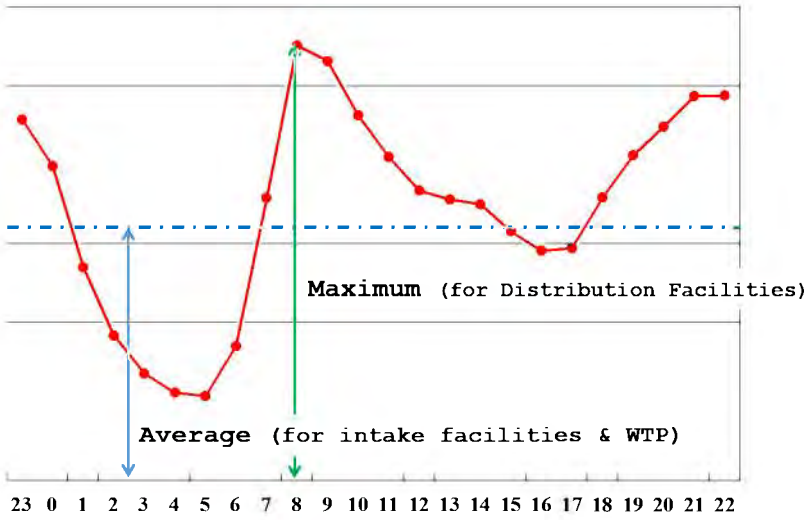
Water demand = **Total Consumption** + **NRW**

(Domestic uses
Institutional uses
Commercial uses)

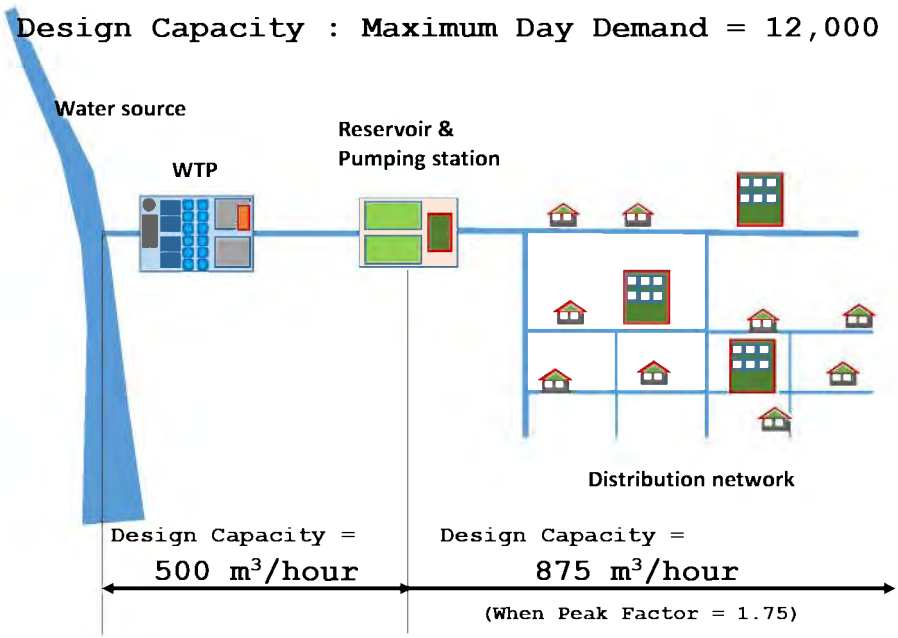
Demand Variations and Demand Factors

- **Minimum day demand**:
  The minimum amount of water required in a single day over a year.
- **Average day demand**:
  The average of the daily water requirement spread in a year.
- **Maximum day demand**:
  The maximum amount of water required in a single day over a year.
- **Peak hour demand**:
  The highest hourly demand in a day.

Peak Hour Demand in Maximum Day



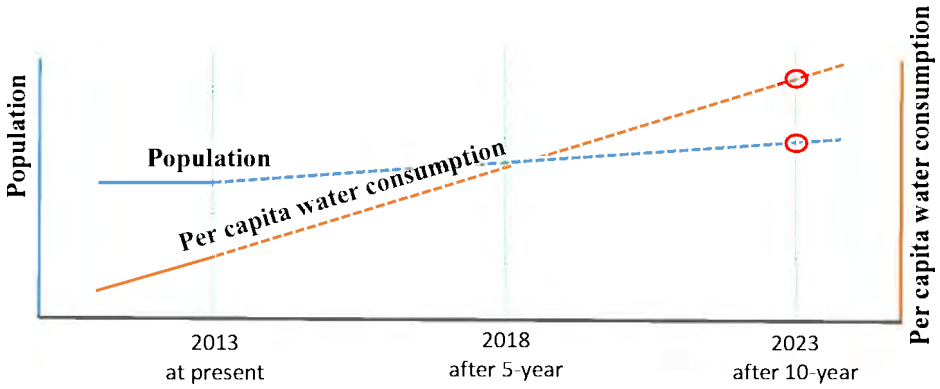
Design Capacity : Maximum Day Demand = 12,000 m³/day



Water Demand = Per capita water consumption x Population + NRW

Water Demand Projections = Water Demand at Targeted year

example: Targeted year = after 10 years



Water Demand for Design of Facilities

Example: Community A

Households (HHs) = 100, average 1 HH = 6 persons
Total served Population = 100 x 6 = 600
Average Water demand = 600 x 50 lpcd = 30,000 l/d

NRW (Leakage ratio) = 15 %
Distributed amount including Leakage
= 30,000 l/d / (1 – 0.15) / 86400 sec/d = 0.41 l/sec

Maximum Water demand
= Average Water demand (including NRW) x 1.30
= 0.41 l/sec x 1.30 = 0.53 l/sec

Reference Multi-Village Pooling Project in Indonesia
Handbook for Community-Based Water Supply Organizations
October 2011

Estimating Quantity of Water Demand

Guiding Principles in Estimation

The Ministry of Public Works Regulation 18/2007 suggests that the projection of water needs be done for a planning period of 15 years, in 5-year intervals. It is necessary to make assumptions on how many additional customers will be served during each interval of the planning period.

- Different components of the system will need to be expanded/developed during the 5 years, according to the following portion of the projected demand:
  - o Water intake – 130% of the volume of total water needs for the day
  - o Water treatment – 120% of the volume of total water needs for the day
  - o Water distribution – 100% of the volume of total water needs for the peak hour of the day
- For the water distribution system, the demand for water should be based on the volume required during peak hours, not just the average during the day. 'Peak hours' refers to the hours of the day during which the volume of water utilization is highest because of simultaneous use. The actual hours when demand is highest should be observed by the water provider, but usually these are during the following times: 06.00- 09.00, 12.00-14.00 and 17.00-19.00

Customer Profiles (1)

Type of Customers	Total Number of Customers	Average Consumption	Annual Consumption	% of Total Annual Water Consumption
1. House connections	300 households x 4 persons = **1,200 persons**	50 liters per capita per day x 365 days	21,900 m^3	85%
2. Stand pipes	2 standpipes x 20 households x 4 persons = **120 persons**	20 liters per capita per day x 365 days	876 m^3	4%
3. Water-using businesses, including restaurants, laundry and clinics	2 establishments x 10 visitors = **20 visitors**	100 liters per visitor per day x 365 days	730 m^3	3%
4. Non-water using businesses, such as offices	2 establishments x 10 employees = **20 employees**	20 liters per employee per day x 20 days x 12 months	96 m^3	0.5%

Customer Profiles (2)

5. School	1 elementary school x 6 levels x 35 students = 210 students	20 liters per student per day x 20 days x 10 months	840 m^3	3.3%
6. Mosque	1 mosque x 210 visitors per week / 7 days = 30 visitors	20 liters per visitor per day x 365 days	219 m^3	.09%
7. Public Market	1 market x 20 stalls = 20 stalls	200 liters per stall per day x 2 days x 12 months	96 m^3	.05%
8. Livestock - cow	40 heads	30 liters per head per day x 365 days	438 m^3	1.7%
9. Livestock - goat	40 heads	20 liters per head per day x 365 days	292 m^3	1.1%
Total Annual Water Consumption			*25,487 m^3*	*100%*

Customer Profiles (3)

Additional Provision for:				
10. Fire fighting, system flushing and other public uses			1,275 m^3	5% of 25,487 m^3
11. Water losses			5,100 m^3	20% of 25,487 m^3
Total Water Needs			**31,862 m^3**	

Lesson 3: Water Sources

1. Classification of Water Sources
2. Source Capacity Measurements
3. Source Water Protection

1. Classification of Water Sources

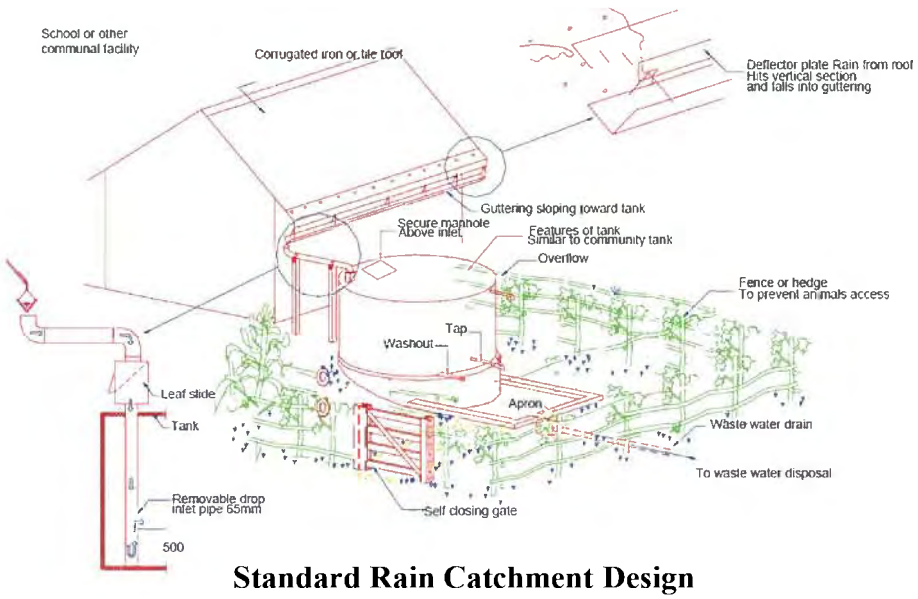
- Rain Water
- **Springs**
- **Infiltration Wells (Riverbed Water)**
- **Groundwater**
- Surface Water

Selecting Sources of Raw Water

Characteristics and Factors to Consider	Spring	Ground Water (Well)	Surface (Ponds, lakes, river, etc.)
Water Quality	Usually moderately satisfactory	Usually satisfactory	Usually less than satisfactory
Source of Pollution and Prevention	Local infiltration of waste, such as from animals grazing around the spring. Fencing off the spring area and protecting the spring with a spring box.	Seepage into the ground, such as from nearby septic tanks or dumpsites. Locating wells at least 10 meters away from a septic tank.	Distributed across the area of the water body from point and non-point sources. General prohibitions or regulated discharge of pollutants into the water.
Treatment	Needs filtration and sedimentation to separate off sand/soil particles. Likely to need disinfection.	Likely to need disinfection	Likely to need sedimentation, filtration and disinfection at the minimum. May need other treatment process.
Skills to Manage Production	Low	Moderate	Moderate to high
Use of Energy to Draw	Naturally surfacing; gravity.	Pumping required to draw water.	Diversion to intake usually does not require pumping
Main Flow of Flood	Important to locate parts of the collection structure (e.g. inlet chamber) away from the flow of the flood.		Important to locate parts of the collection structure (e.g. inlet chamber) away from the flow of the flood.

Multi-Village Pooling Project in Indonesia Handbook for Community-Based Water Supply Organizations

(1) Rain Water



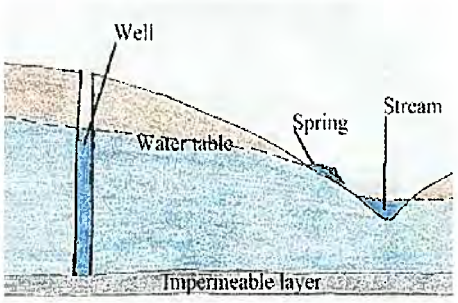
Standard Rain Catchment Design

(2) Springs

Outcrops of groundwater

(ex. appear as-)

- small water holes
- wet spots at the foot of hills



To obtain satisfactory water

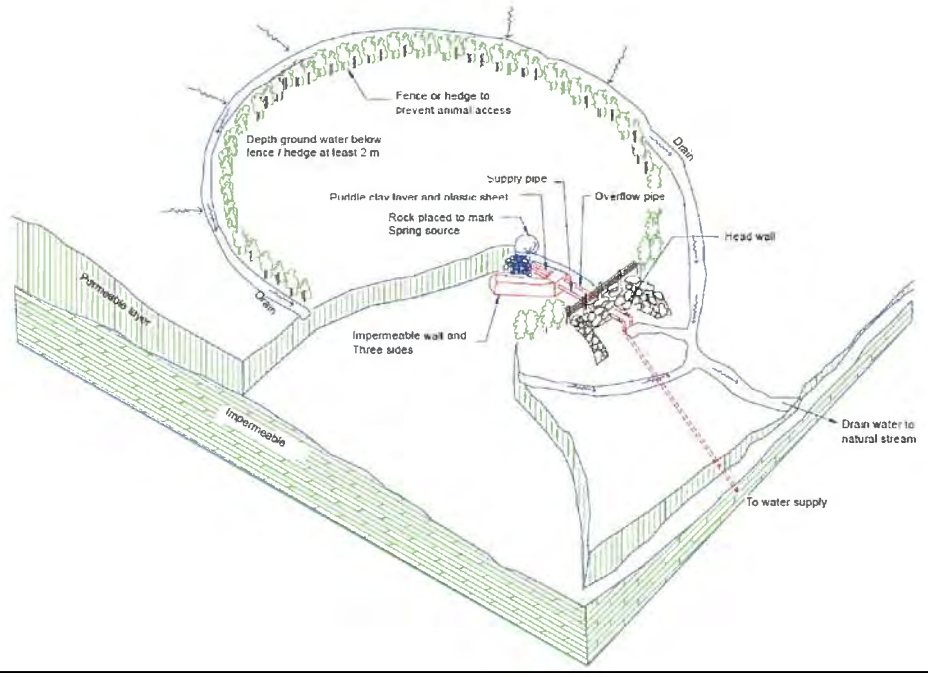
- Eliminate surface water intrusion
- Prevent animals from gaining access to the spring
- No immediate upstream settlements

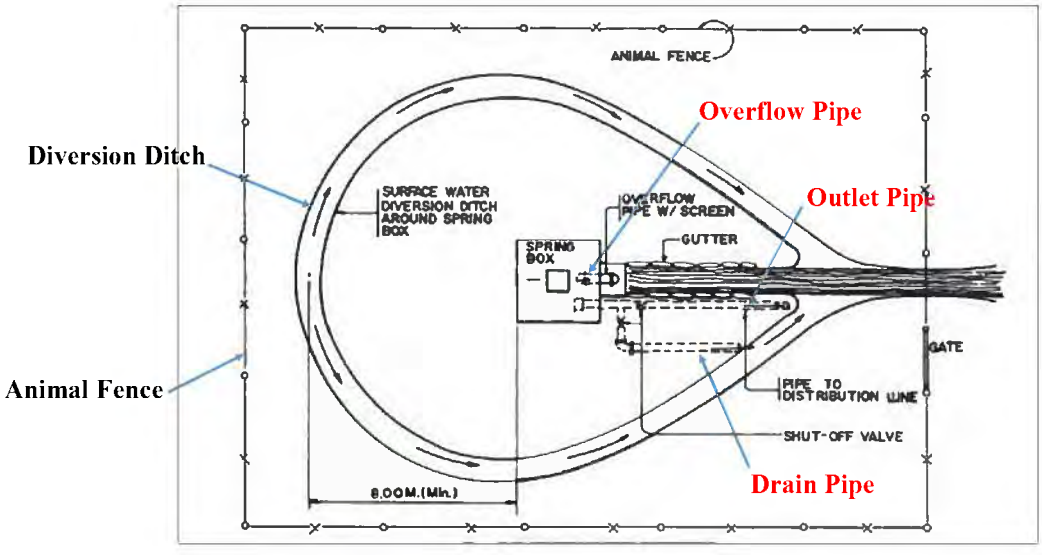
Springs should

- be protected from surface-water pollution
- have a watertight cover
- be obtained by gravity flow
- have inspection manholes

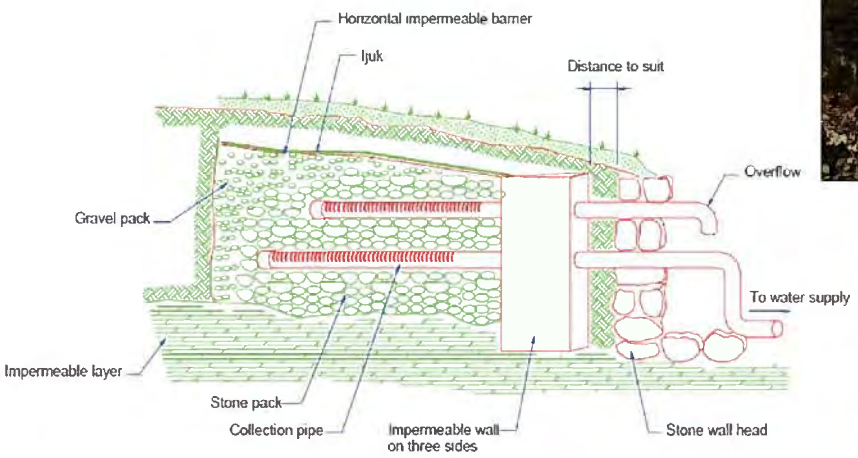
(should be locked)

Intake Facilities from Spring

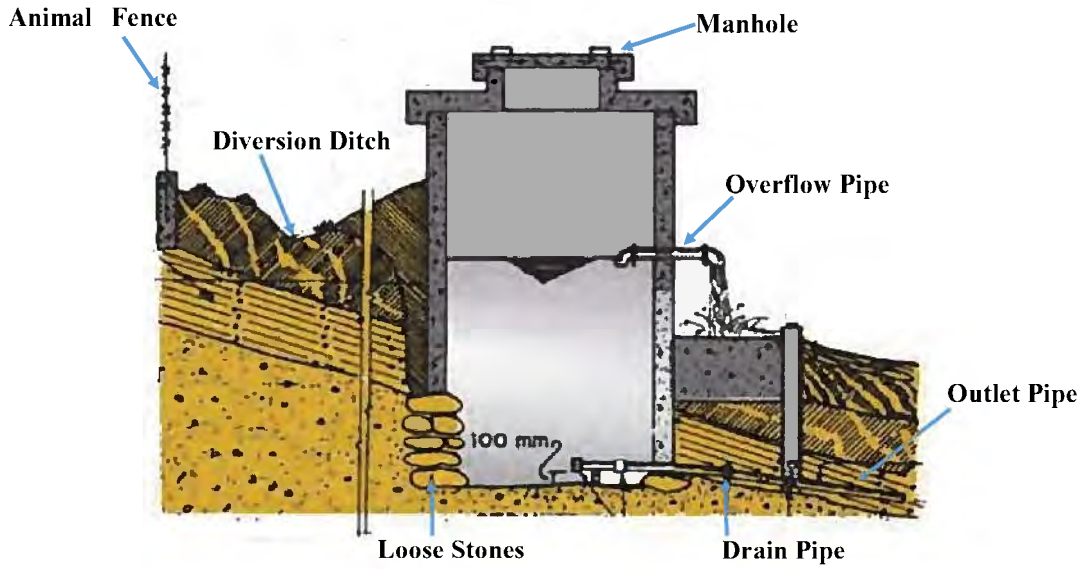




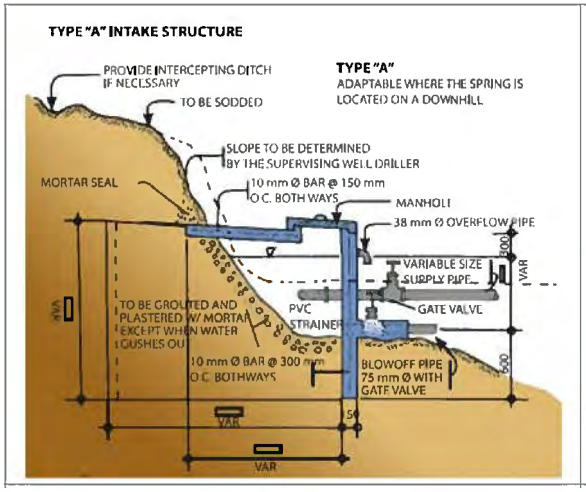
- Ground Plan -

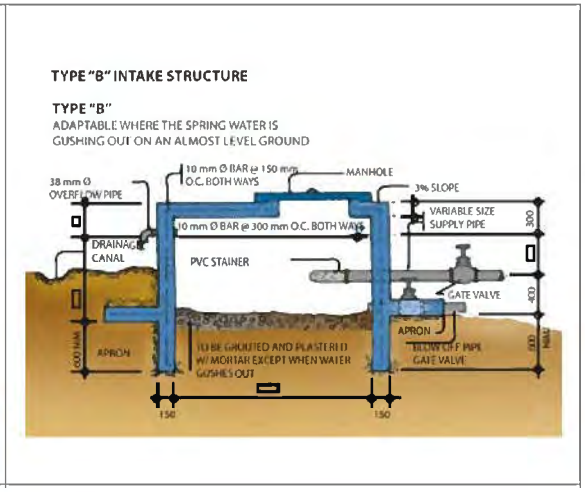


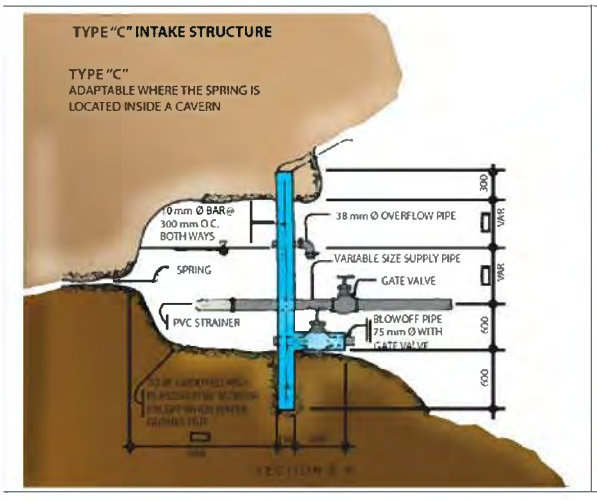
Basic Design Features of Spring Box

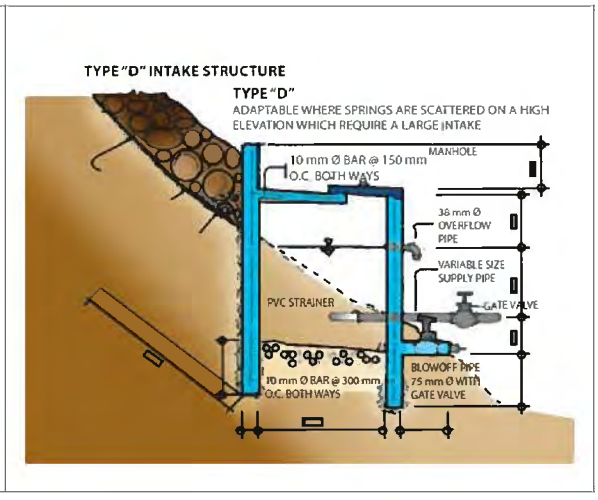


- Sectioned Drawing -

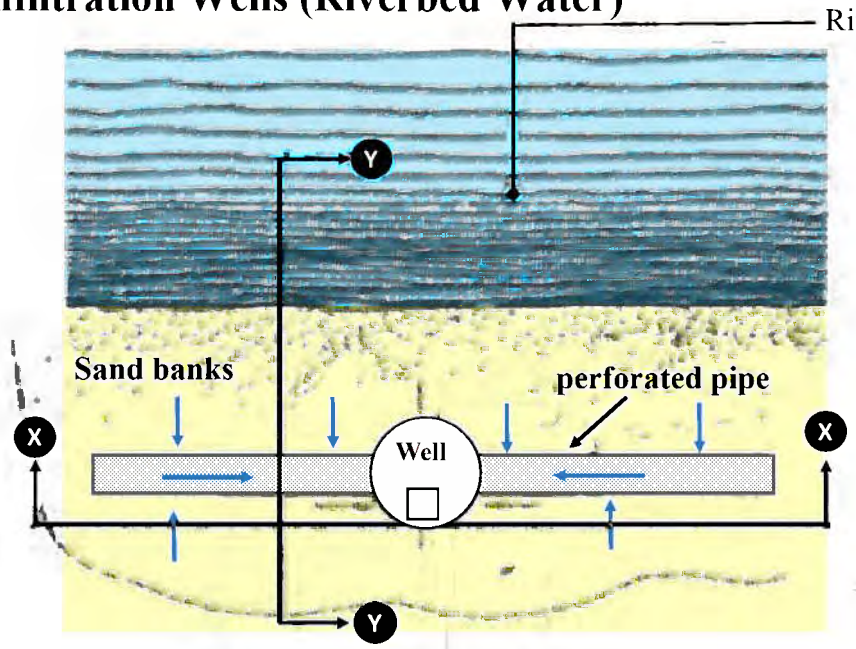

TYPE "A" INTAKE STRUCTURE
PROVIDE INTERCEPTING DITCH IF NECESSARY
TO BE SODDED
TYPE "A"
ADAPTABLE WHERE THE SPRING IS LOCATED ON A DOWNHILL
SLOPE TO BE DETERMINED BY THE SUPERVISING WELL DRILLER
MORTAR SEAL
10 mm Ø BAR @ 150 mm O.C. BOTH WAYS
MANHOLE
38 mm Ø OVERFLOW PIPE
VARIABLE SIZE SUPPLY PIPE
GATE VALVE
PVC STRAINER
TO BE GROUTED AND PLASTERED W/ MORTAR EXCEPT WHEN WATER GUSHES OUT
10 mm Ø BAR @ 300 mm O.C. BOTHWAYS
BLOWOFF PIPE 75 mm Ø WITH GATE VALVE
VAR

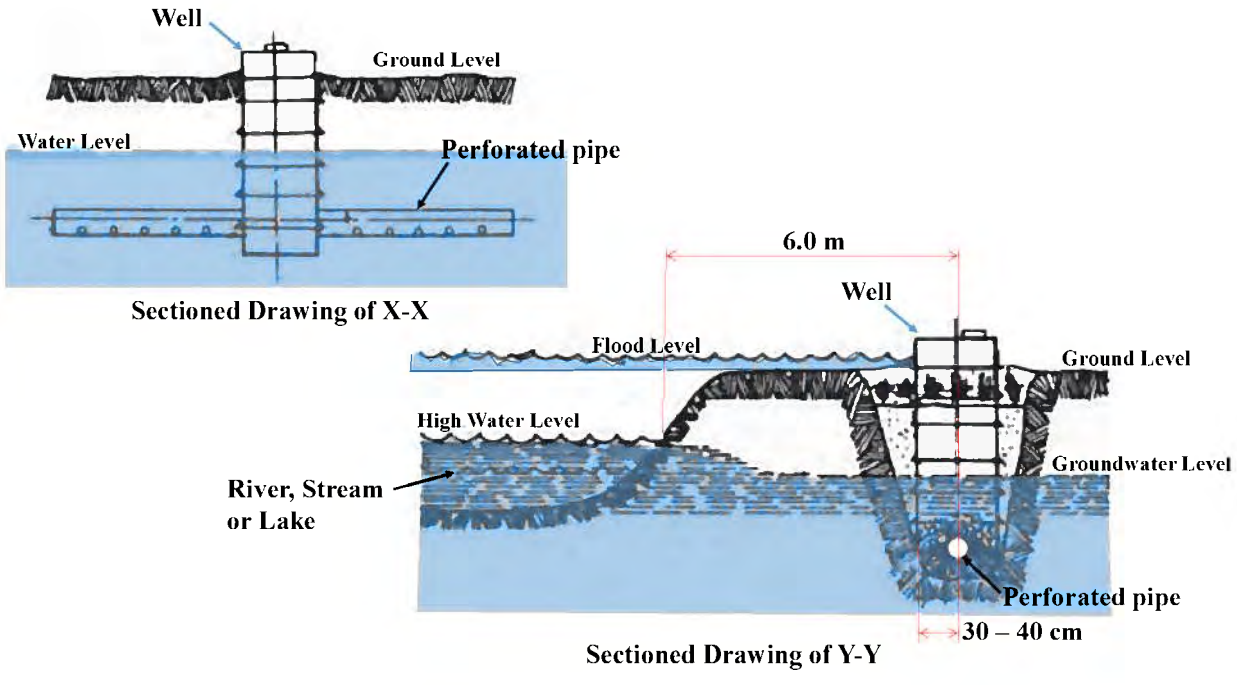

TYPE "B" INTAKE STRUCTURE
TYPE "B"
ADAPTABLE WHERE THE SPRING WATER IS GUSHING OUT ON AN ALMOST LEVEL GROUND
38 mm Ø OVERFLOW PIPE
10 mm Ø BAR @ 150 mm O.C. BOTH WAYS
MANHOLE
3% SLOPE
VARIABLE SIZE SUPPLY PIPE
10 mm Ø BAR @ 300 mm O.C. BOTH WAYS
DRAINAGE CANAL
PVC STAINER
GATE VALVE
APRON
TO BE GROUTED AND PLASTERED W/ MORTAR EXCEPT WHEN WATER GUSHES OUT
BLOWOFF PIPE
GATE VALVE


TYPE "C" INTAKE STRUCTURE
TYPE "C"
ADAPTABLE WHERE THE SPRING IS LOCATED INSIDE A CAVERN
10 mm Ø BAR @ 300 mm O.C. BOTH WAYS
38 mm Ø OVERFLOW PIPE
VARIABLE SIZE SUPPLY PIPE
SPRING
GATE VALVE
PVC STRAINER
BLOWOFF PIPE 75 mm Ø WITH GATE VALVE


TYPE "D" INTAKE STRUCTURE
TYPE "D"
ADAPTABLE WHERE SPRINGS ARE SCATTERED ON A HIGH ELEVATION WHICH REQUIRE A LARGE INTAKE
MANHOLE
10 mm Ø BAR @ 150 mm O.C. BOTH WAYS
38 mm Ø OVERFLOW PIPE
VARIABLE SIZE SUPPLY PIPE
PVC STRAINER
GATE VALVE
BLOWOFF PIPE 75 mm Ø WITH GATE VALVE
10 mm Ø BAR @ 300 mm O.C. BOTH WAYS

(3) Infiltration Wells (Riverbed Water)

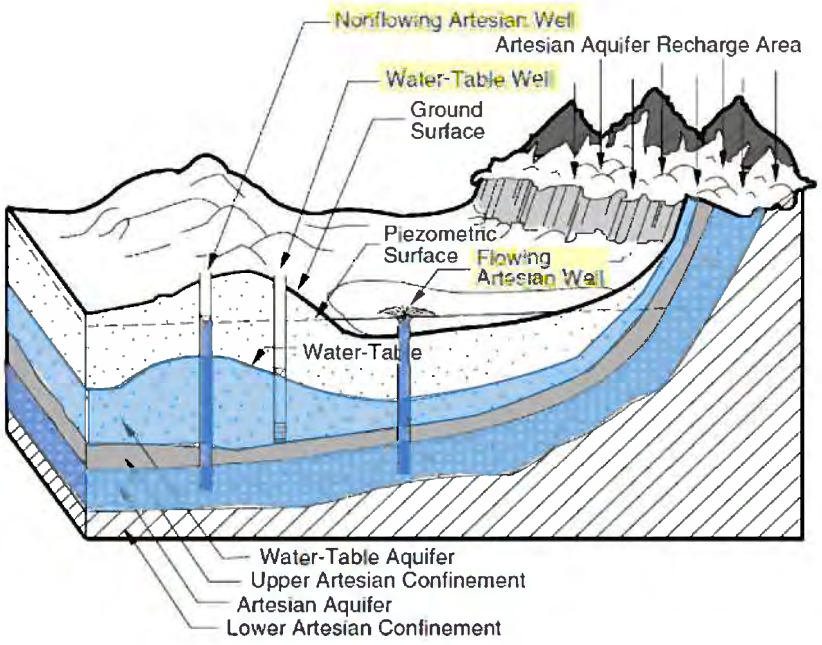




(4) Groundwater

Classification of Wells Based on Aquifer Tapped

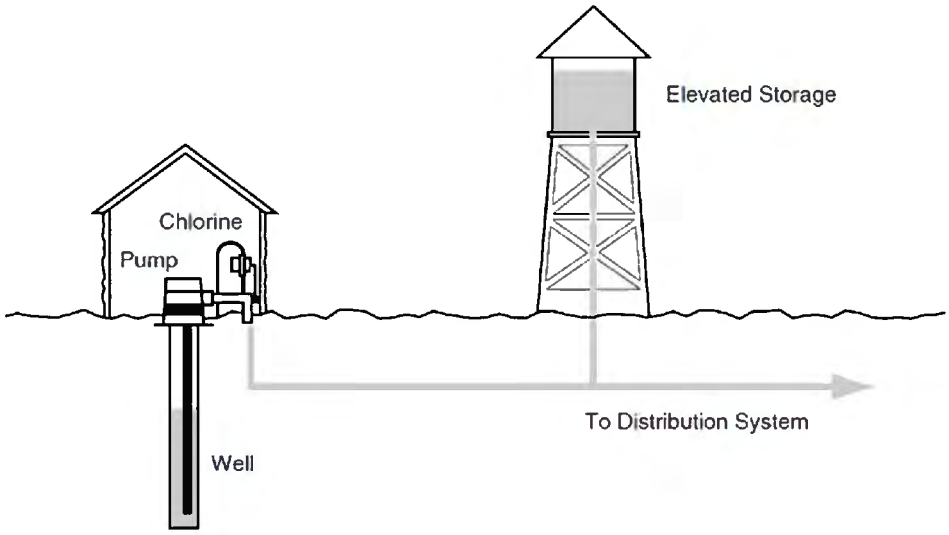
1. **Shallow Wells**
   - less than 20 meters deep
   - great dependence on seasonal rainfalls
2. **Deep Wells**
   - over 20 meters deep
   - not confined by an overlying impermeable layer
3. **Artesian Wells**
   - from an aquifer confined between less permeable materials (clay, rock)



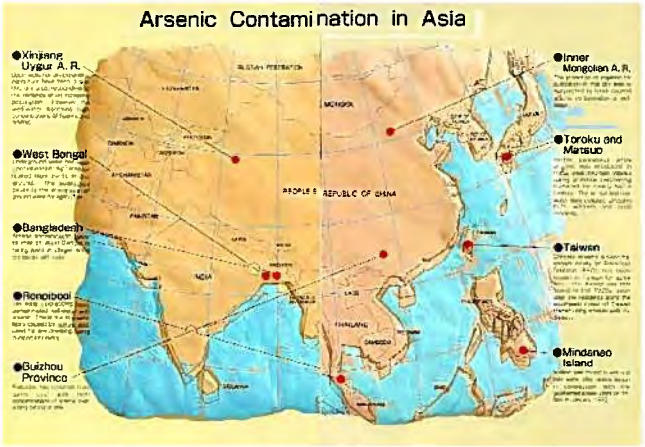
Water-Table Well
- **Shallow Well**
- **Deep Well**

Artesian Well
- **Nonflowing Artesian Well**
- **Flowing Artesian Well**

Simple Well System



Arsenic Problem



(5) Surface Water

- include water from streams, rivers, lakes, ponds, seas and oceans
- contains organic and inorganic minerals
- needs expensive water treatment
- should be avoided for rural water supplies

2. Source Capacity Measurements

Measurements of Discharge

a. Volumetric Method

b. Flow Method using V-Notch Weir

c. Rough Flow-Rate Method

a. Volumetric Method

Data:

Volume of oil drum used : 200 liters

Number of drums used : 1

Time to fill the drum : 30 seconds

Required: Well yield

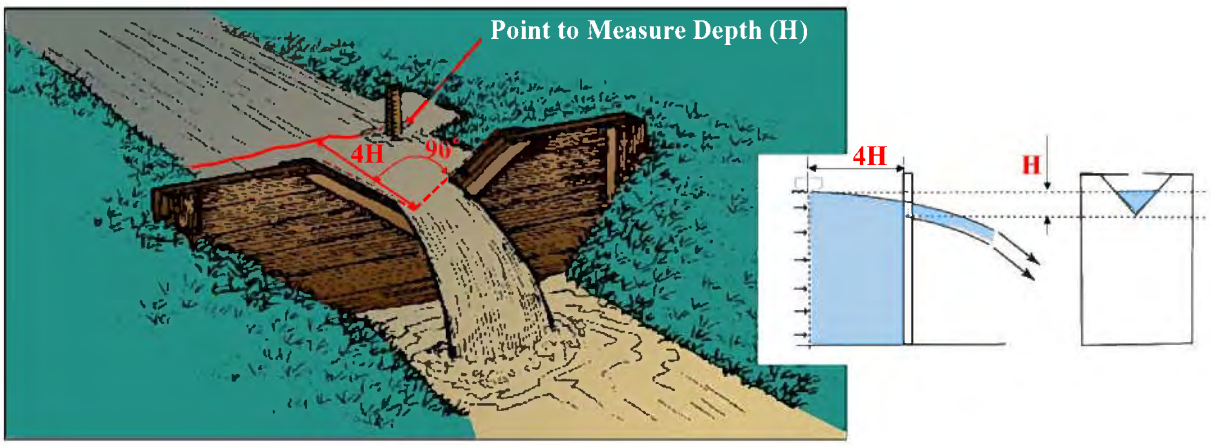
1. **Calculate the total volume of water collected, V**

$$V = Volume\ of\ container\ used = 200\ liters$$

2. **Calculate the yield of well, Q**

$$Q = \frac{Volume\ of\ water\ collected}{time\ in\ seconds} = \frac{200\ l}{30\ s} = 6.67\ lps$$

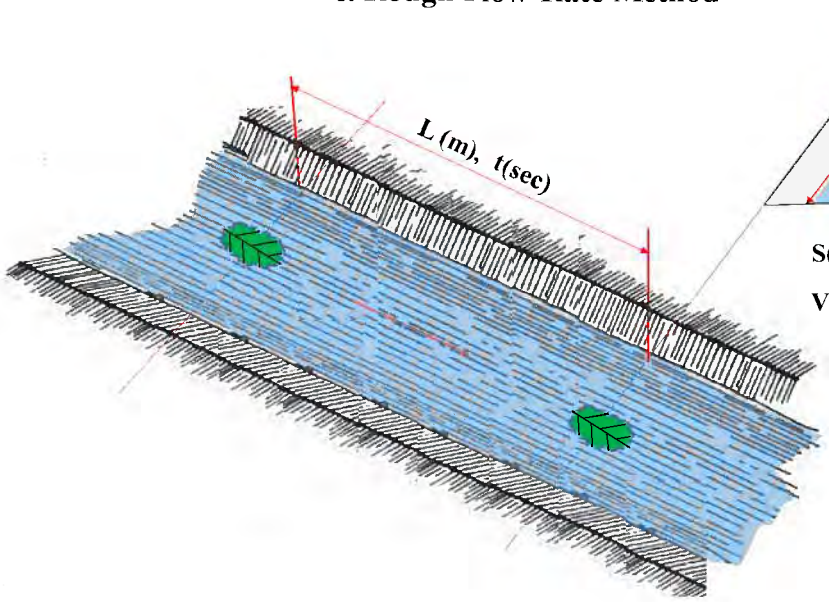
b. Flow Method using V-Notch Weir



60° : Q = 0.008 x $H^{2.5}$

90° : Q = 0.0138 x $H^{2.5}$ **Q : l/sec, H : cm**

c. Rough Flow-Rate Method



$S(m^2) = (W1+W2) \times \frac{1}{2} \times D$

$V(m/sec) = L/t$

$Q(m^3/sec) = V \times S$

3. Source Water Protection

In any drinking water system, protecting source water is a critical step towards avoiding drinking water contamination. Protected watersheds will improve the quality of the source water.

When the water source have been polluted, there are several option:

(1) To change the water source

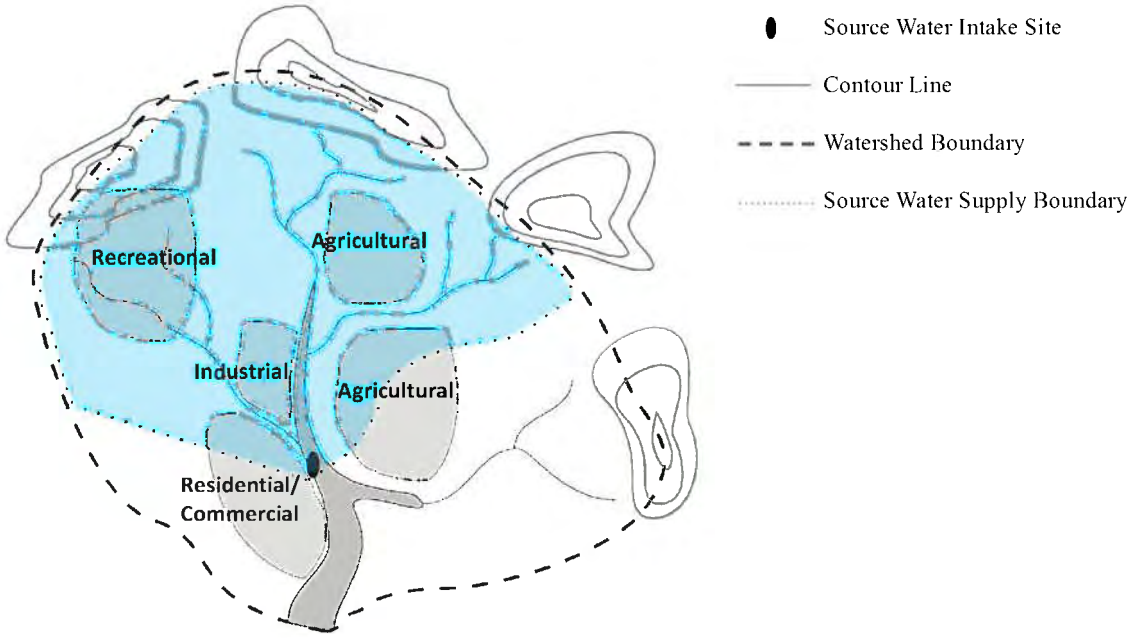
(2) To install a suitable water treatment system

(3) To remove the polluting source

Main Pollution Sources

Pollution Source	Possible Contaminants
Solid waste landfill	Heavy metals, chloride, sodium, wide variety of organic & inorganic compounds
Liquid waste storage ponds	Heavy metals, solvents and brines
Septic tanks/leach fields	Organic solvents, nitrates, sulfates and microbiological contaminants
Agricultural activities	Nitrates, herbicides and pesticides
Infiltration of urban runoff	Inorganic compounds, heavy metals and petroleum products

Generalized land-use overlay with watershed delineation map



Lesson 4 Water Treatment

Water treatment ideally should be avoided.

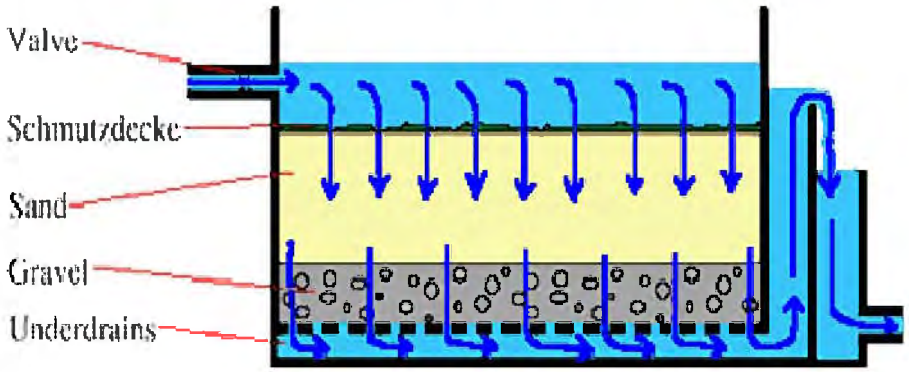
It is best to select sources with good water quality at the outset to reduce facility and operation costs.

- **Slow Sand Filtration**
- **Rapid Sand Filtration**
- **Disinfection**
- **Altona Case**

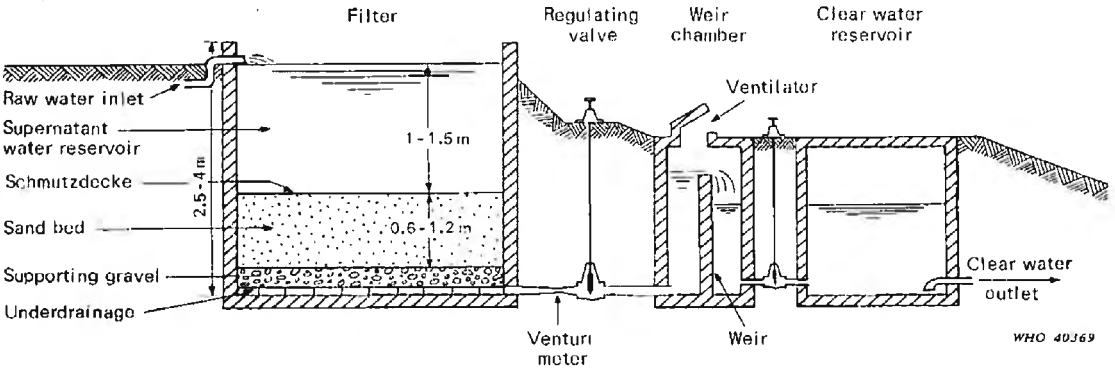
Slow Sand Filtration vs Rapid Sand Filtration

	Slow Sand Filtration	Rapid Sand Filtration
Filtration rate:	**4 - 6 m/day**	**120 – 150 m/day**
Turbidity (Raw Water) :	**under 20 ntu**	**under 1000 – 2000 ntu**
Pre-treatment:	**none / Sedimentation**	**Coagulation, flocculation, Sedimentation**

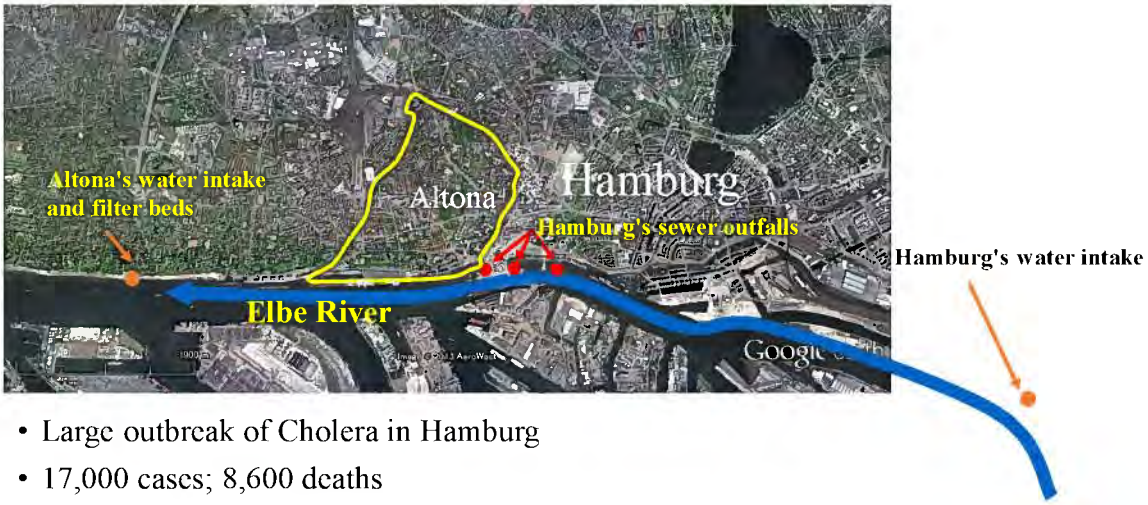
Slow Sand Filter



Slow Sand Filtration



Altona Case: Cholera outbreak in Hamburg, Germany in 1892



- Large outbreak of Cholera in Hamburg
- 17,000 cases; 8,600 deaths
- Very few cases in neighborhoods served by Altona's filtered water supply
- Hamburg's sewers were upstream from Altona's intake!

Rapid Sand Filtration

Coagulation and Flocculation

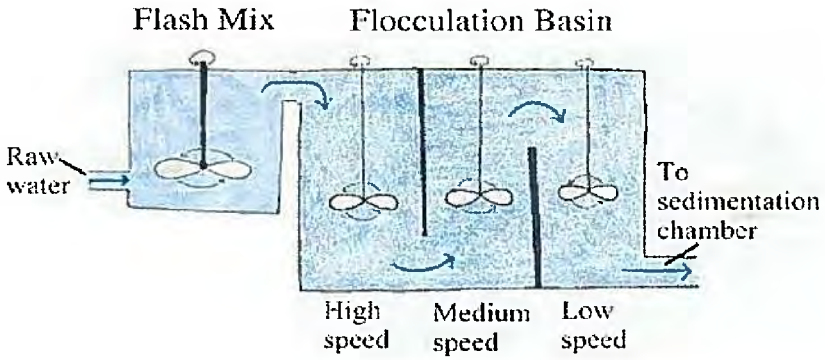
↓

Sedimentation

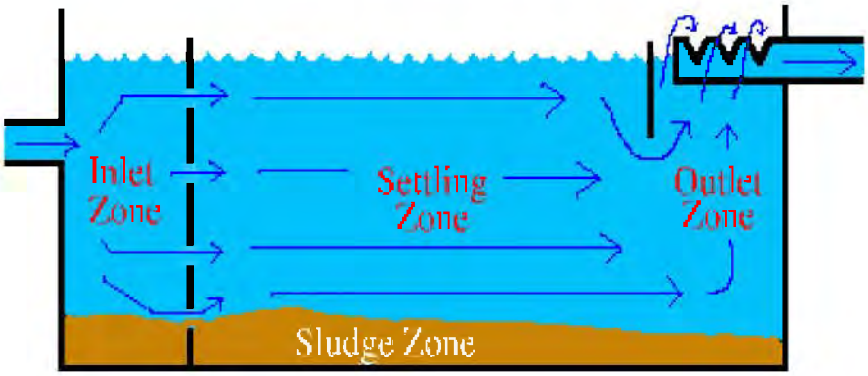
↓

Rapid Sand Filter

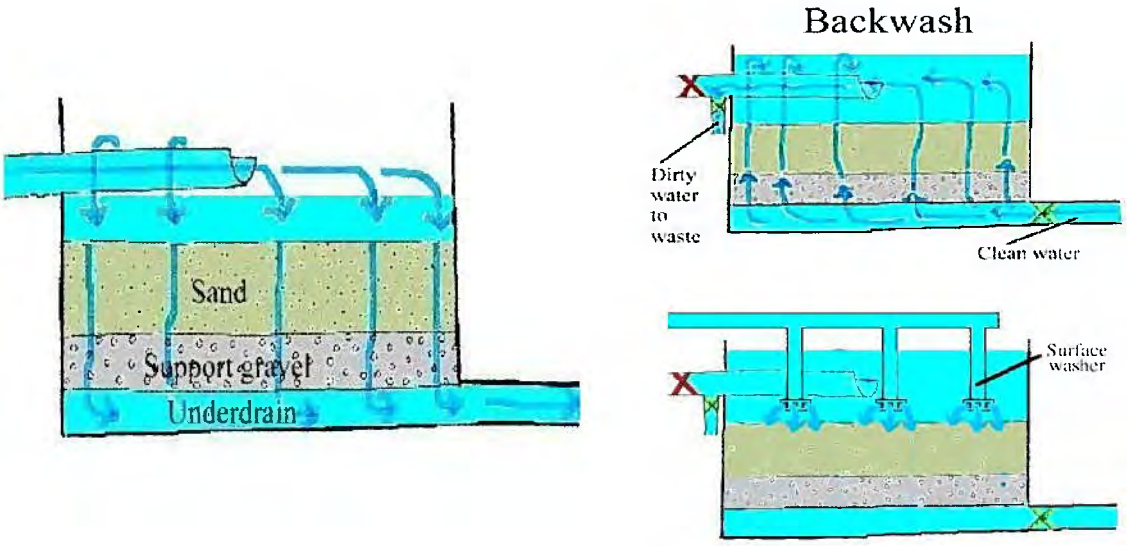
Coagulation and Flocculation



Sedimentation



Rapid Sand Filter



Disinfection

1. **Water disinfection: the removal, deactivation or killing of pathogenic microorganisms.**

2. **To ensure that drinking water is free from disease-causing microorganisms.**

Disinfection is often universally employed by water distribution systems, even when water at the source is deemed already potable – as a precautionary measure to control the spread of waterborne diseases.

Chlorine Gas

Chlorine + Water ⟶ **Hypochlorous Acid + Hydrochloric Acid**

$Cl_2 + H_2O$ ⟶ **HOCl + HCl**

Hypochlorites

Sodium hypochlorite (NaOCl)

Sodium hypochlorite + Water ⟶ **Hypochlorous Acid + Sodium Hydroxide**

$NaOCl + H_2O$ ⟶ **HOCl + NaOH**

Calcium hypochlorite ($Ca(OCl)^2$)

Calcium hypochlorite + Water ⟶ **Hypochlorous Acid + Calcium Hydroxide**

$Ca(OCl)_2 + 2\ H_2O$ ⟶ **2 HOCl + $Ca(OH)_2$**

Lesson 5 Transmission and Distribution Systems

- Transmission and Distribution System
- Pipeline Hydraulics
- Pipeline Design Criteria
- Pipeline Materials Selection
- Appurtenances for Transmission and Distribution Mains
- Reservoir (Tank)
- Public Faucets/Service Connections

1. Transmission & Distribution System

(1) Through gravity flow

This is the ideal set-up when the location of the water source is at a considerably higher elevation than the area to be served.

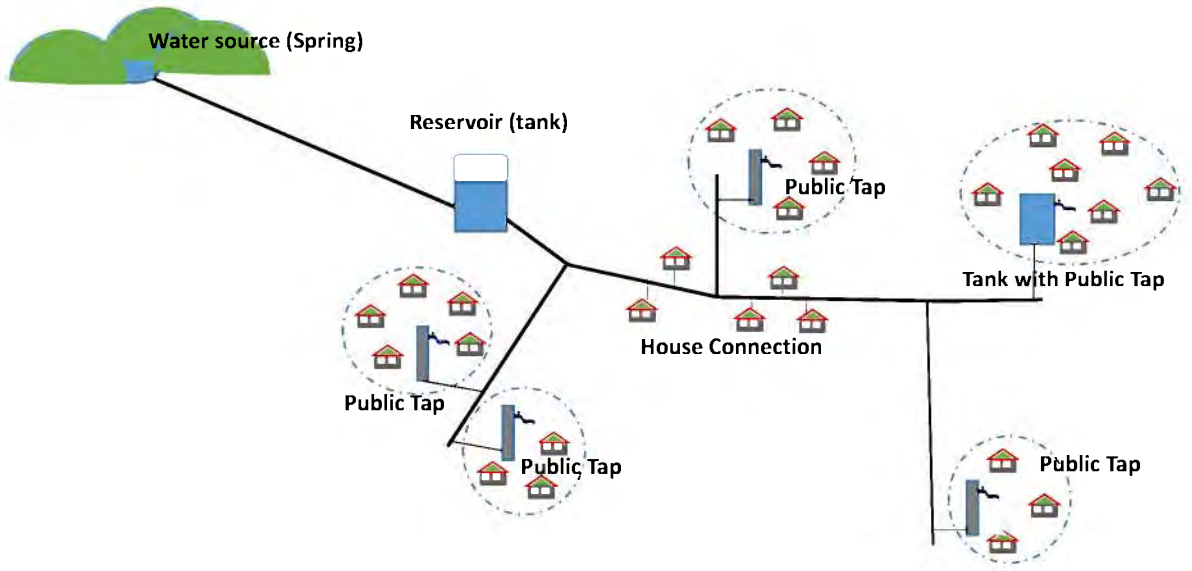
(2) Through pumping with storage

Water is either (a) pumped to a distribution pipe network, then to consumers, with excess water going to a storage tank, or (b) pumped to a storage tank first, then water is distributed by gravity from the tank to the consumers.

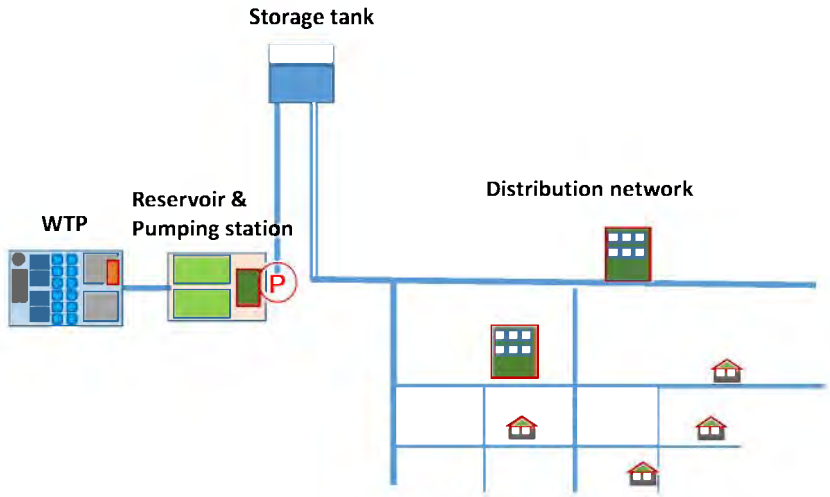
(3) Through direct pumping to the distribution system

Water is pumped directly from the source to the distribution system to the consumers.

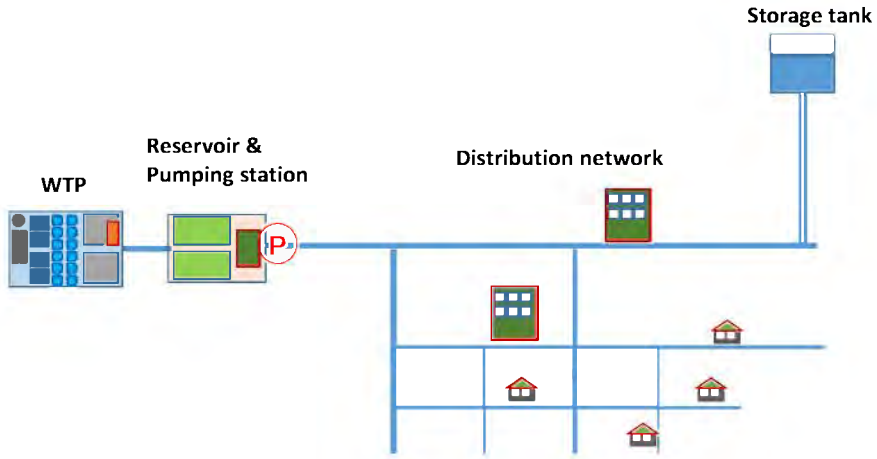
(1) Distribution by gravity



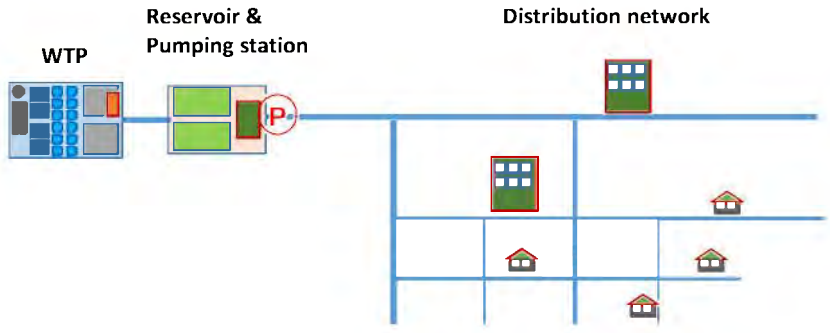
(2)Distribution by pump with storage



(2)Distribution by pump with storage

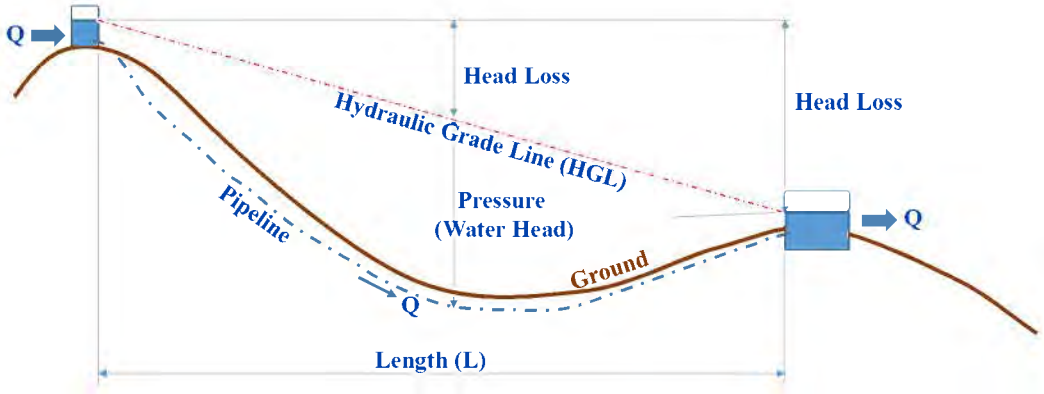


(3) Distribution by pump



2. PIPELINE HYDRAULICS

(1) Pressure (= Water Head)
(2) Head Losses
(3) Hydraulic Grade Line (HGL)



Hazen–Williams Formula

- Darcy-Weisbach formula
- **Hazen-Williams formula**
- Mannings formula
- Combined Darcy-Weisback and Colebrook-White equation.

$$Q = 0.25783C \cdot (D/1000)^{2.63} \cdot (h/L)^{0.54} \cdot 1000$$

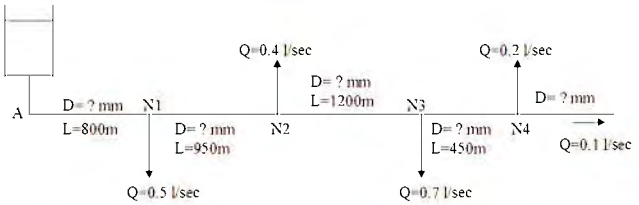
$$D = 1.6258C^{-0.38} \cdot (Q/1000)^{0.38} \cdot (h/L)^{-0.205} \cdot 1000$$

$$h = 10.666C^{-1.85} \cdot (D/1000)^{-4.87} \cdot (Q/1000)^{1.85} \cdot L$$

$$C = (Q/1000)/(D/1000)^{2.63}/(h/L)^{0.54}/0.27853$$

h: Head Loss(m)
C: Flow(Roughness) coefficient
D: Pipe diameter(m)
Q: Flow rate(m^3/s)
L: Pipe Length(m)

Practice



Node	GL(m)	Qflow	Qout	h(m)	L(m)	C	D (mm)	R-Head
A	45		-	-	-	-	-	20.00
N1	30		0.5		800	120		
N2	25		0.4		950	120		
N3	20		0.7		1200	120		
N4	20		0.2		450	120		

3. Pipeline Design Criteria

1. Minimum pressure at the remotest end of the system = 3 m

2. Maximum velocity of flow in pipes

a. Transmission Line = 3.0 m/s

b. Distribution Line = 1.5 m/s

3. Minimum velocity of flow in pipes = 0.40 m/s

4. Demand Factor: varies from 0.3 (minimum demand) to 3.0 (peak-demand)

5. Allowable head loss: minimum = 0.50 m/1,000 m, maximum = 10 m/1,000 m

6. Allowable pressure: minimum = 3 m, maximum = 70 m

4. Pipeline Materials Selection

Parameters	GI	PVC	PE
Crushing strength versus superimposed loads in trench	Excellent	Fair	Poor
Burst strength versus internal pressure	Excellent	Good	Good
Durability	Fair	Excellent	Excellent
Resistance to corrosion	Poor	Excellent	Excellent
Flow capacity	Fair	Excellent	Excellent
Resistance to external mechanical injury	Excellent	Fair	Fair
Ease of installation	Easy	Must be handled gently. Must be buried	
Pipe Cost	High	Low	Low
Cost per fitting	Low	High	High
Number of fittings	High	High	High

NWRC RWS Volume I, Design Manual

Comparison of Pipe materials

Material Property	DI	PVC	HDPE
Tensile strength	60,000 psi	7,000 psi	3,200 psi
Corrosion resistance (int)	Good – w/cement lining	Excellent	Excellent
UV resistance	Excellent	Gradual strength decline	Yes - w/carbon black
Diameter range	3" - 64"	4" - 12" (C900) 14" - 48" (C905)	4" - 63"
Type of joints	Push-on or mechanical	Push-on or mechanical	Heat fused
Need for special bedding for typical installations	No	Yes	No
Anticipated service life	100 years	50 - 100 years	50 years

EPA 816-D-09-001 November 2009

5. Appurtenances for Transmission and Distribution Mains

(1) Valves

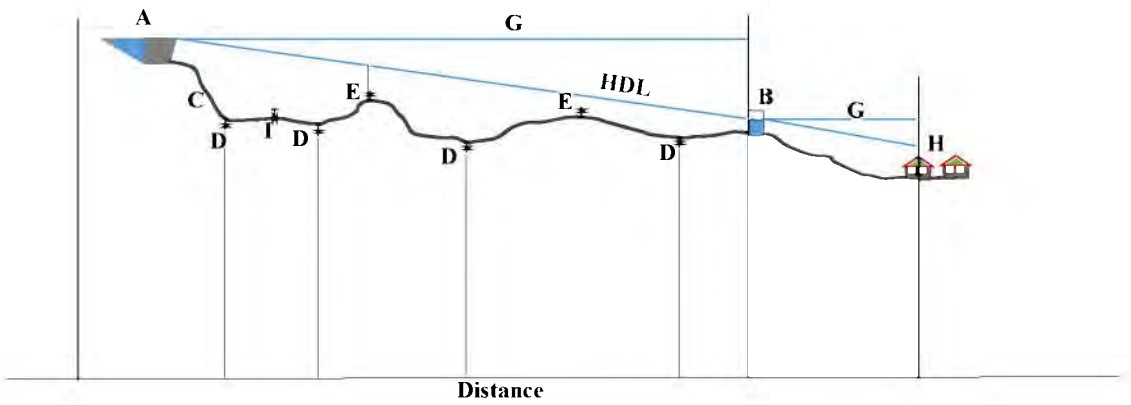
a. **Isolation Valves**

b. **Directional Valves**

c. **Altitude Valves**

d. **Air Release Valves and Vacuum Breaking Valves**

e. **Pressure Reducing Valves**



A = Intake structure
B = Storage reservoir
C = Pipeline
D = Blow-off valve
E = Air valve

HDL = Hydraulic grade line
G = Static head
H = Rural town or Village
I = Sectioning valve (every 1.5 km)

(2) Fittings

a. To connect the same type and size of pipe:

Union
Coupling

b. To connect two pipes of different sizes:

Reducers

c. To change the direction of flow:

Elbow
Tee
Cross

d. To stop the flow:

Caps, plugs and blind flanges

6. Reservoir (Tank)

Capacity

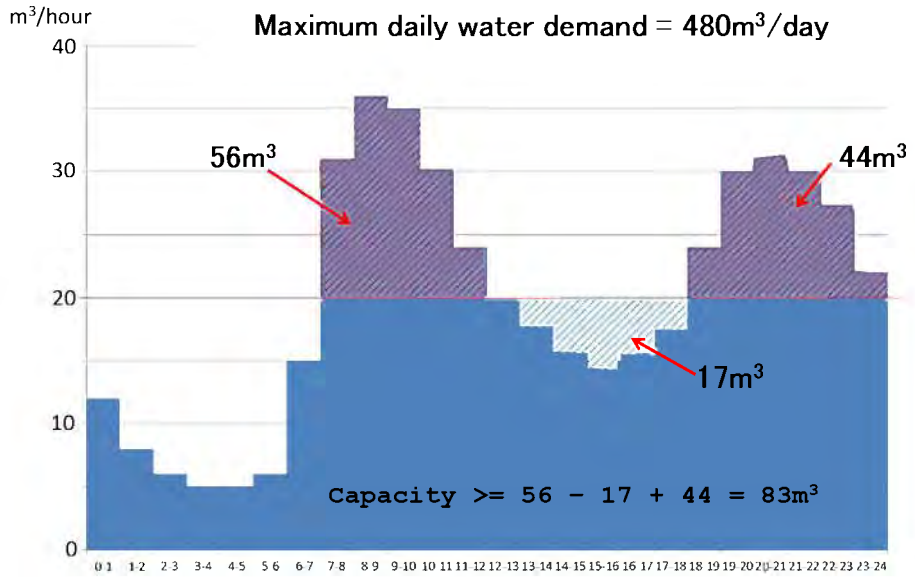
(1) Cr = (1/4) (ADD)

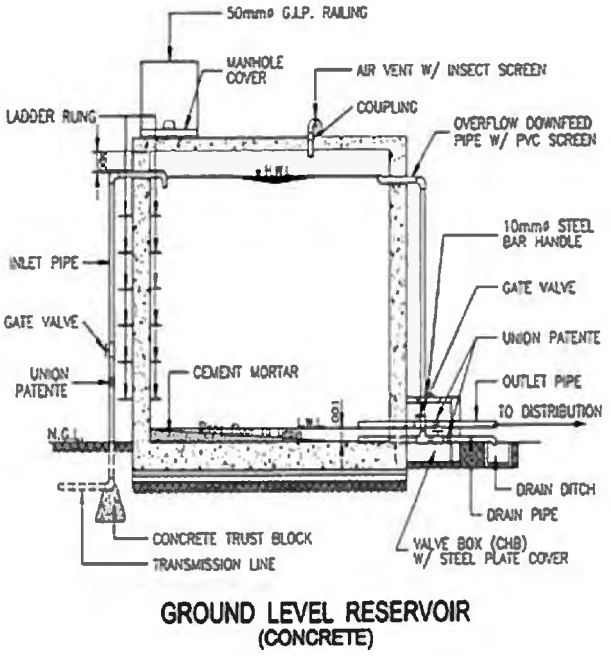
where:
Cr = Reservoir capacity in liters
ADD = Average day demand in liters per day

(2) To calculate from hourly demand of MDD

where:
MDD = Maximum day demand

Calculation of Reservoir's Capacity





GROUND LEVEL RESERVOIR
(CONCRETE)

(1)Inlet Pipe
Gate Valve

(2)Outlet Pipe
Gate Valve

(3)Overflow Pipe
Connect to drain pipe

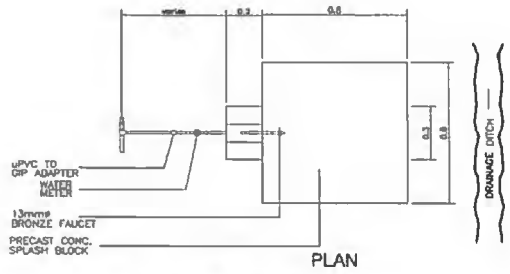
(4)Drain Pipe
Gate Valve, Drain Ditch

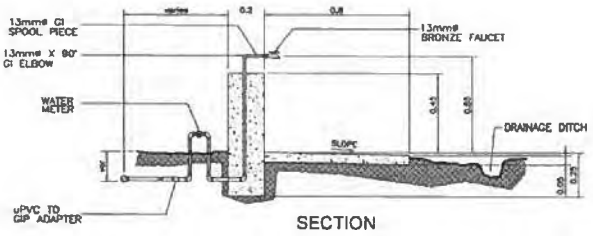
(5)Air Vent
Insect Screen

(6)Manhole

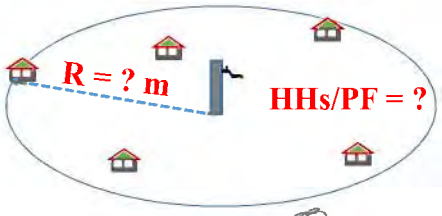
(7)Water Level Indicator

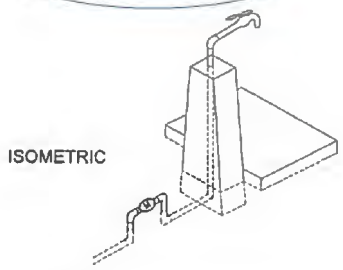
6. Public Faucets/Service Connections





Service Level





PUBLIC FAUCET INSTALLATION
SINGLE TYPE FAUCET

Service Level

Per Capita Water Consumption = ?

Public Tap or House Connection ?

- Multi-tap in house

100 l/c/d

→ 50m (2.5min)

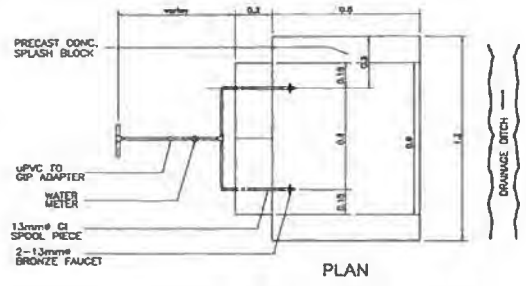
50 l/c/d

→ 50m – 500m (2.5min - 15min)

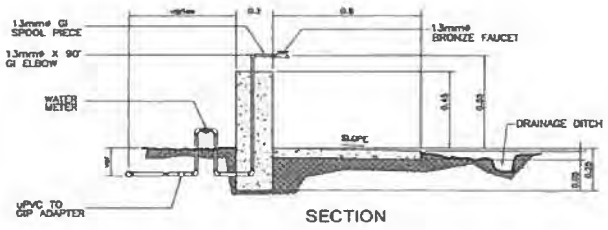
20 l/c/d

→ 500m (15min)

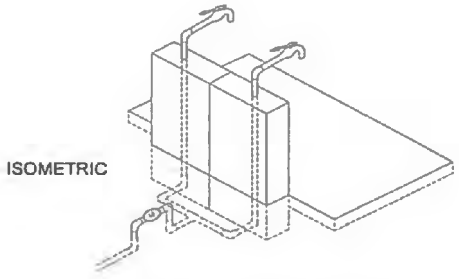
Below 5 l/c/d



PLAN



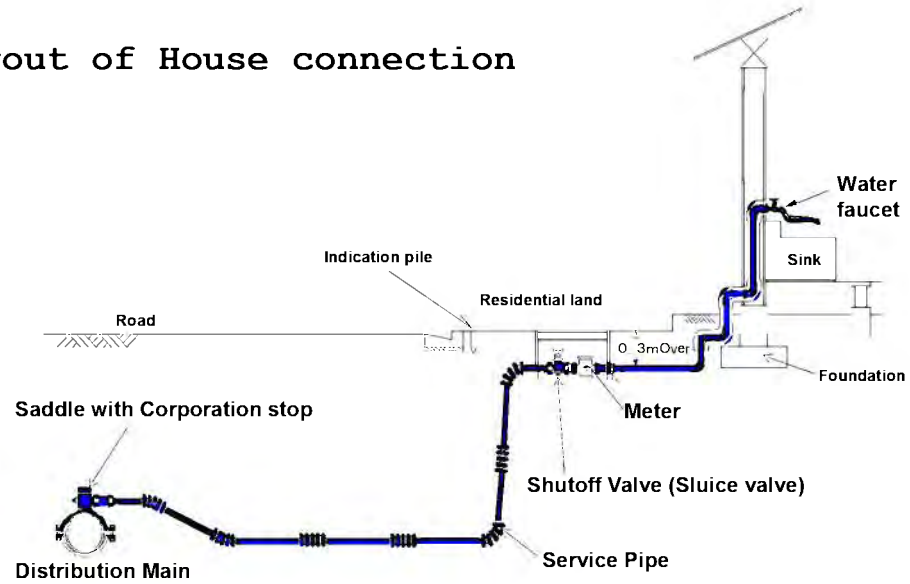
SECTION



ISOMETRIC

PUBLIC FAUCET INSTALLATION
DOUBLE TYPE FAUCET

Layout of House connection

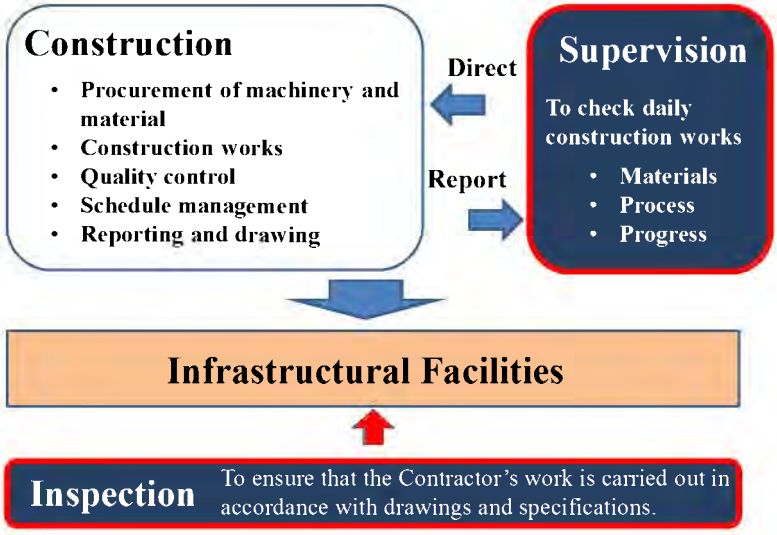


PART II
Inspection for Rural Water Supply Project

Lesson 6 Construction Inspection

- What is construction inspection?
- Inspection procedures
- Check points

1. What is construction inspection?



YES or NO, ALL or NOTHING

DISCUSSION

What is/are necessary to secure good quality of infrastructure ?

Ability of Construction Company

or

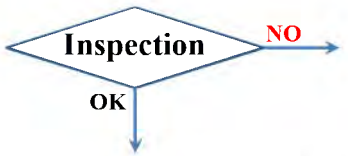
Supervision

or

Inspection

Inspection is

To ensure that the Contractor's work is carried out in accordance with contract documents and specifications of the project.



To inform the contractor
The contractor must correct unacceptable work.
The payment is postphoned.

Project owner recieve the facilities and pay the contruct amount.

Operation

Contract Documents (drawings)
location, physical aspects, dimensions of the work, layouts, profiles, cross-sections, and other details.

Specifications
the written technical directions and requirements for the work, and providing instructions that are not specifically indicated on the drawings.

Construction Inspector's Job Description

In general the inspection personnel must ensure the following items:

a. All material and workmanship are in accordance with the specifications and the acceptable good practice.

b. The quality control testing of material is at an acceptable level of workmanship.

c. All works are to be in accordance with the level, alignment, dimension, and cross-sections as specified in construction drawings and specifications.

2. Inspection procedures

Pre-Inspection

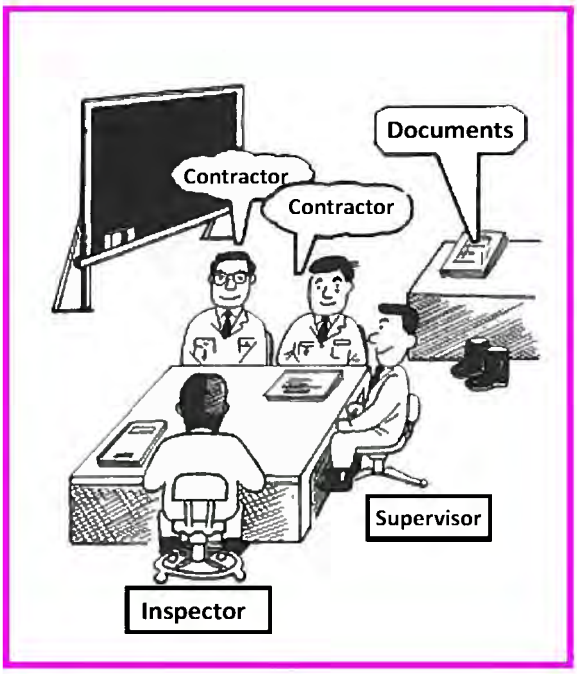
1. To receive all the plans, approved drawings, specifications, and other documents pertaining to the assigned project.

Beginning of Inspection

2. To be explained about the outline of the whole construction works and the range of the inspection using drawings and BOQ by the Contractor.

Inspection

3. To start the site inspection or the document inspection.



At the start of Inspection

a. Explanation of Construction Works by Contractor
- Drawings
- BOQ
- Technical specification

b. Explanation on the range of the Inspection with
- Drawings
- BOQ

Site Inspection

Document Inspection

2-1. Site Inspection

Intermediate inspection and Completion inspection

(1) To measure the dimensions of facilities, and check whether the measurements meet with the drawings.

(2) To check the materials about the amount and qualities.
- On-site examination of materials
- Count the amount at site
- Documents of quality guarantee and examination
- Statements of delivery

(3) To check the external appearance by watching
- Workmanship
- Situations under the construction

2-2. Document Inspection

(1) Confirmation of Documents submitted
1) Contract Document: the contract amount and payment conditions
2) Bill of Quantities showing unit prices and quantities
3) Description of changes, alteration or variations, if any
4) Site Inspection Report by KDD
5) Digital data of BOQ

(2) Confirmation of Payment conditions

(3) Calculation in billing sheets

(4) Confirmation of completed works in BOQ, drawings and photos

(5) Confirmation of work schedule

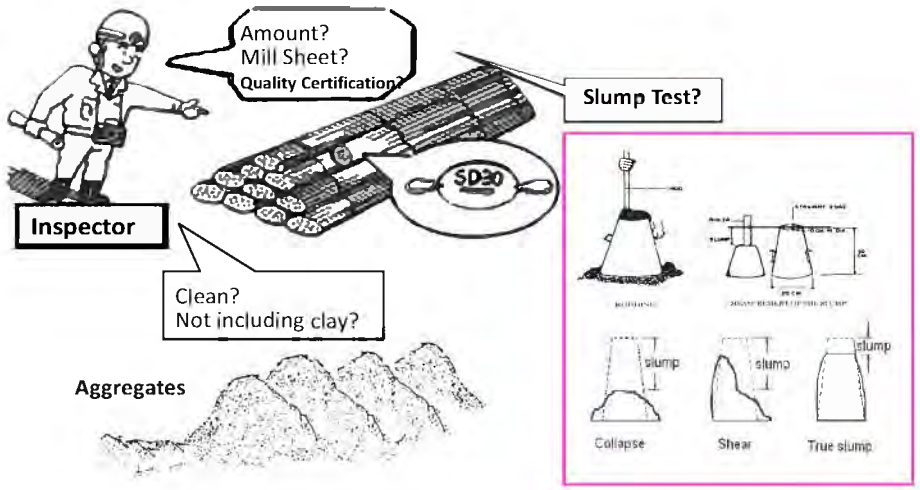
(6) Confirmation of inspection result by KDD

3. Check points

1. To check the materials
2. To check the Processes
3. To measure the dimensions of facilities
4. To check the external appearance
5. To check the BOQ
6. To check the construction photos
7. Examples of check points

3-1. To check the materials

To check the materials about the amount and qualities.



GUIDELINES IN PRODUCING GOOD CONCRETE

1. **Using the Right Materials**
   - Portland Cement
   - Aggregate (Gravel & Sand)
   - Water
   - Admixtures
2. **Obtaining the Right Mix Proportions**
3. **Controlling the Proportion and Mixing Method**
   - A homogeneous mixture
   - Uniform batches
4. **Placing**
5. **Curing**
   - To prevent freshly poured concrete from drying out too quickly

CONCRETE INSPECTION

The Inspector necessarily must refer to the design drawings and specifications, to ensure that these are complied with, and to keep a record that shall cover the following:

1. **Quality and proportions of concrete materials and strength of concrete;**
2. **Construction and removal of forms and shoring;**
3. **Placing of reinforcements;**
4. **Mixing, placing and curing of concrete;**
5. **Sequence of erection and connection of walls; and**
6. **General progress of work.**

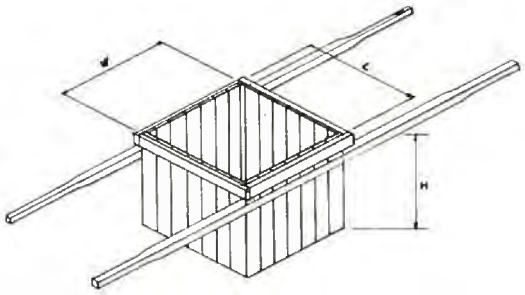
Fine Aggregates or Sand - Removing Clay and Silt -

Clay and silt present in excessive quantities can be detected by conducting the following test:

1. **Fill a quart jar (1.14 liter) or Erlenmeyer flask with sand to a depth of 5.0 cm (2 inches);**
2. **Add water until the jar or flask is 3/4 full;**
3. **Shake the contents for about one minute with the last few shakes in a sidewise direction;**
4. **Allow the jar to stand for 30 minutes;**
5. **Observe the top of the sand. If there is more than 3.2 mm layer of sediment, the sand where the sample was taken is unsuitable for construction purposes. However, the aggregates in question can be used after washing and removing the undesirable materials.**

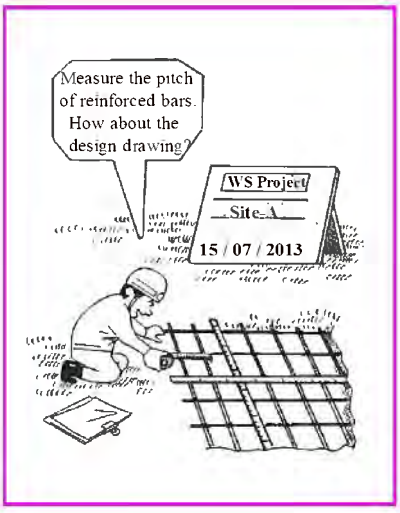
Typical concrete mixes and their uses

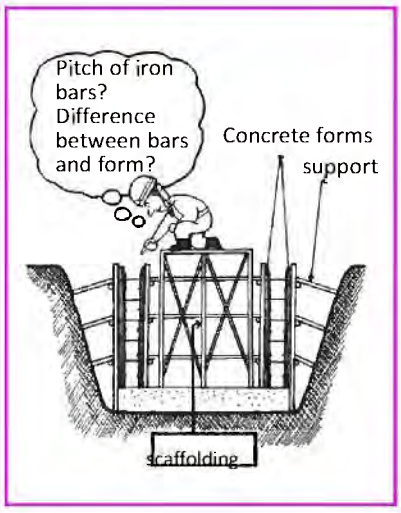
Class	Typical Concrete Mixes (volume proportions)				Quantity of Materials per m^3 of Concrete				Usage
	Cement	Water	Sand	Gravel	Cement		Sand	Gravel	
					bags	m^3	m^3	m^3	
AA	1	0.7 – 1.0	1.5	3.0	10.4	0.294	0.44	0.88	Foundation
A	1	0.7 – 1.0	2.0	4.0	7.9	0.223	0.45	0.9	Beams & Slabs
B	1	0.7 – 1.0	2.5	5.0	6.5	0.184	0.46	0.92	Columns
C	1	0.7 – 1.0	3.0	6.0	5.5	0.156	0.47	0.94	Flooring on fill, and pavements
D	1	0.7 – 1.0	3.5	7.0	4.8	0.136	0.48	0.96	Big Mass Footings



Capacity (m^3)	Inside Measurements		
	Length (m)	Width (m)	Height (m)
0.10	0.4	0.4	0.63
0.20	0.6	0.6	0.56
0.30	0.8	0.8	0.47

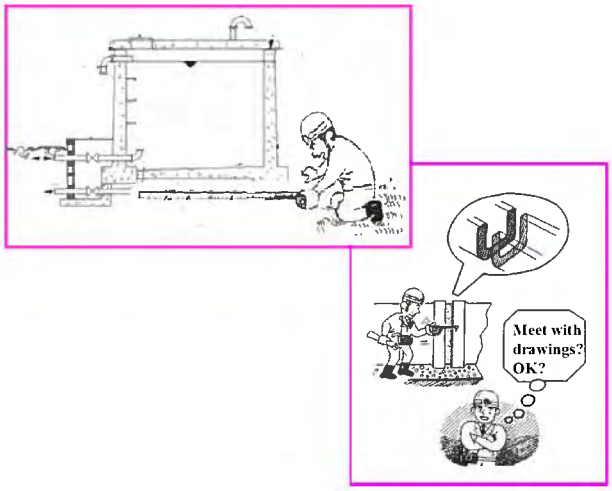
3-2. To check the Processes





3-3. To measure the dimensions of facilities

To measure the dimensions of facilities, and check whether the measurements meet with the drawings.



3-4. To check the external appearance

Cold Joints

Nobuaki Otsuki, Junji Yokokura and Takahiro Nishida
Actual Technological Levels of Concrete in Developing Countries
- Concrete Problems in the World-

Bad Examples

Trace of Bubble

Lackof corner

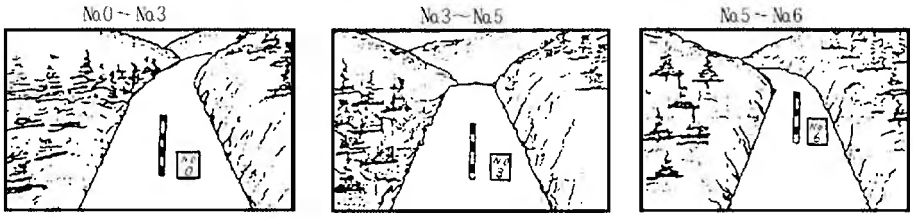
3-5. To check the BOQ

Item	Shape/ Spec.	unit	Quantity			Remarks
			Contract	Execution	Execution Rate (%)	
Pipe Laying	D 50 mm	m	1,500	1,350		
Concrete Tank	2 x3 x2.5		1	1		RC
Excavation	0.4 x 0.3	m3	180	162		0.12m3/m

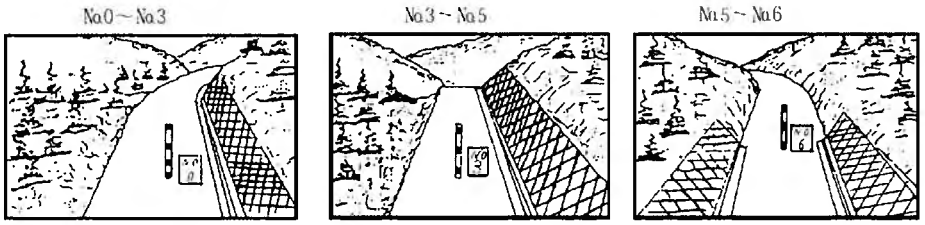
3-6. To check the construction photos

1. **Photos of pre-construction photos and the completion**
2. **Photos of under-constructing (building methods)**
3. **Photos of using materials**
4. **Photos of material qualities (material testing)**
5. **Photos of facilities dimensions photos**

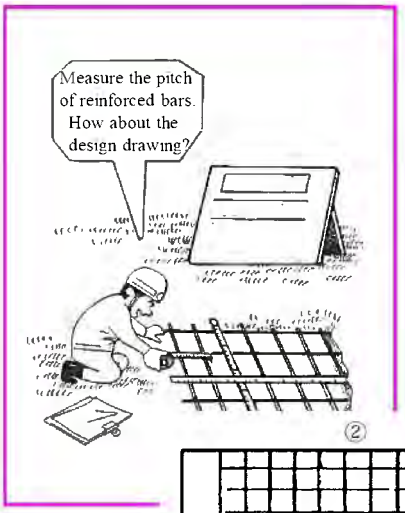
Pre-Construction



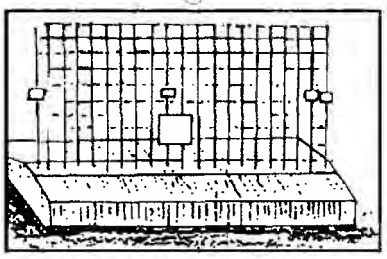
Post-Construction



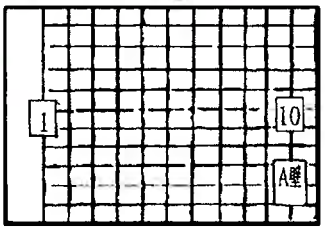
Photos of Iron Bars



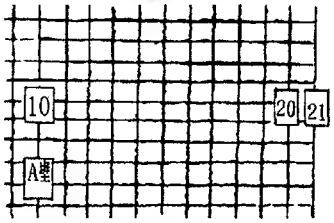
①



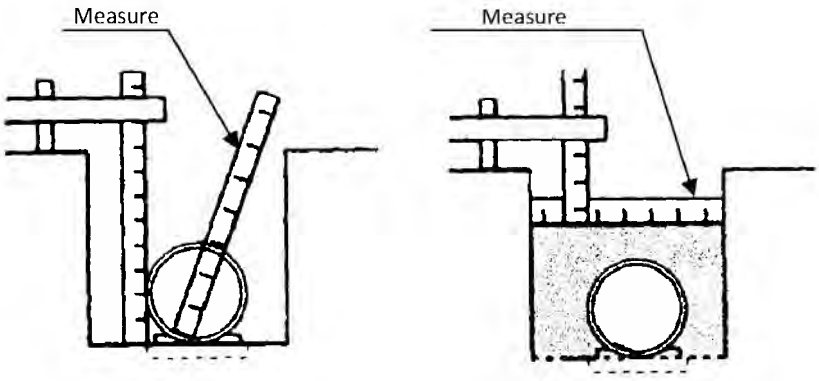
②



③



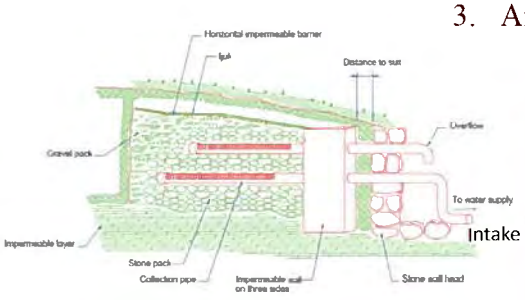
Photos of Pipe Laying

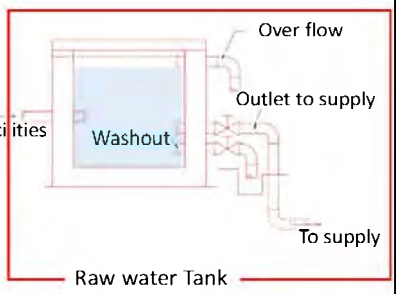


3-7. Examples of check points

Water Source and Intake Facilities

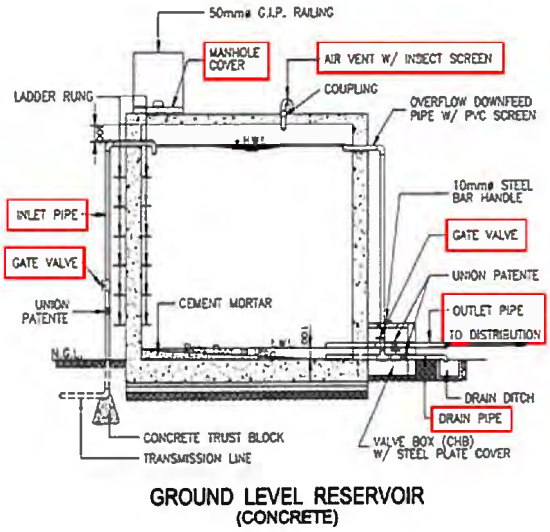
1. Water quantity of the source
2. Water quality of the source
3. Amount of the supplied water





To built a raw water tank.

Reinforced Concrete Reservoir



GROUND LEVEL RESERVOIR
(CONCRETE)

(1) Inlet Pipe & Valve

(2) Outlet Pipe & Valve

(3) Overflow Pipe

(4) Drain Pipe & Valve

(5) Air Vent

(6) Manhole

(7) Water Level Indicator

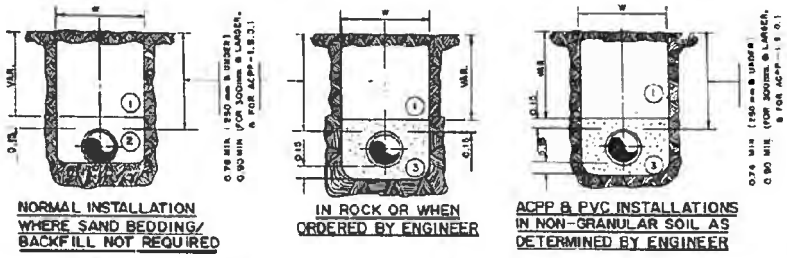
No valve on the inlet pipe.

No valve on the outlet pipe.

Points of Pipeline Inspection

1. Materials
2. Length and Diameter
3. Excavation and Pipe Laying
4. Pipeline Profile
5. Appurtenances for Pipeline
6. Thrust Blocks and Anchors

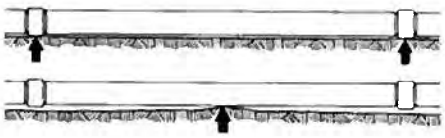
Excavation and Pipe Laying



① Compacted selected native material backfill.
② Compacted selected native material in 0.15 m layers.
③ Approved sand bedding & backfill hand placed & compacted.

Right

Wrong

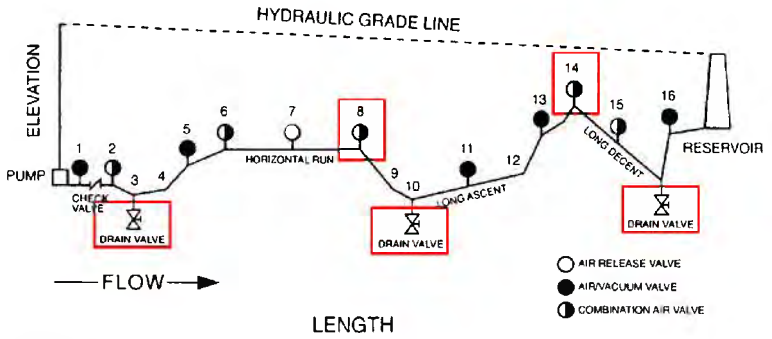


Incorrect Pipe connection and Bending

To make clear which is the main line and which are the branches.

To use a bend joint (22½).

Sample Pipeline Profile Illustrating Valve Locations



NO.	DESCRIPTION	RECOMMENDED TYPES	NO.	DESCRIPTION	RECOMMENDED TYPES
1	Pump Discharge	Air/Vacuum for Pumps	9	Decrease Downslope	No Valve Required
2	Incr. Downslope	Combination	10	Low Point	No Valve Required
3	Low Point	No Valve Required	11	Long Ascent	Air/Vac or Combination
4	Increase Upslope	No Valve Required	12	Increase Upslope	No Valve Required
5	Decrease Upslope	Air/Vac or Combination	13	Decrease Upslope	Air/Vac or Combination
6	Beginning Horizontal	Combination	14	High Point	Combination
7	Horizontal	Air/Rel or Combination	15	Long Descent	Air Release or Combination
8	End Horizontal	Combination	16	Decrease Upslope	Air/Vac or Combination

Air Valve Locations Along a Pipeline

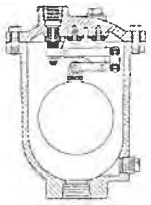
Air valves are installed on a pipeline to exhaust air and admit to prevent vacuum conditions and air-related surges. The AWWA Steel Pipe Manual recommends Air Valves at the following points along a pipeline.

1. **High Points:** Combination Air Valve
2. **Long Horizontal Runs:** Air Release or Combination Valve at 380 to 760 m intervals.
3. **Long Descents:** Combination Valve at 380 to 760 m intervals.
4. **Long Ascents:** Air/Vacuum Valve at 380 to 760 m intervals.
5. **Decrease in an Up Slope:** Air/Vacuum Valve
6. **Increase in a Down Slope:** Combination Air Valve

From "Theory, Application, and Sizing of Air Valves" (Val-Matic Valve and Manufacturing Corporation)

Air Release Valves

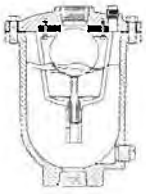
The valve has a small precision orifice to release air under pressure continuously during pipeline operation.



AIR RELEASE VALVE

Air/Vacuum Valves

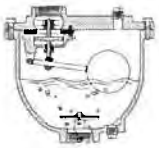
An Air/Vacuum Valves is installed downstream of pumps and at high points to exhaust large volumes of air during pump start-up and pipeline filling. The valve also will admit large volumes of air to prevent a vacuum condition from occurring in the pipeline and to allow for draining.



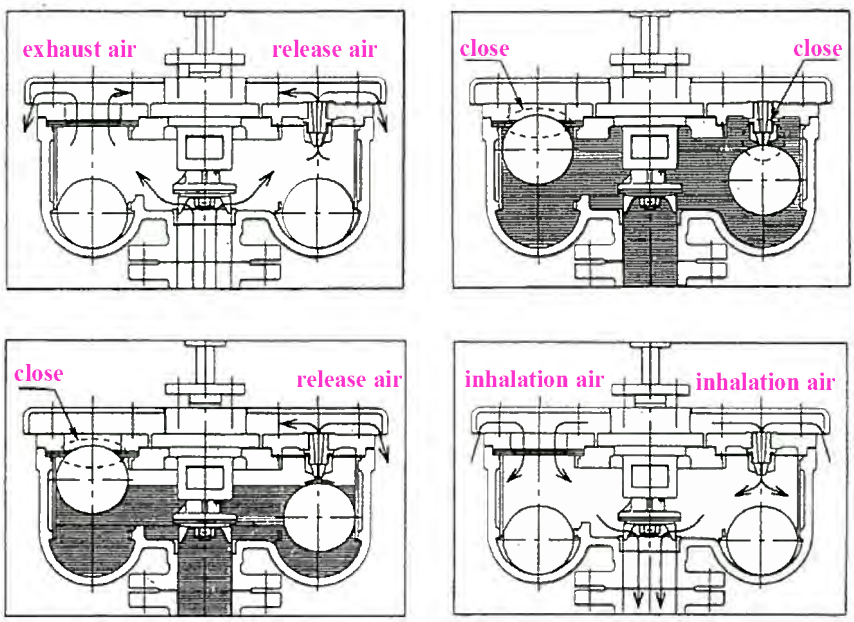
AIR/VACUUM VALVE

Combination Air Valves

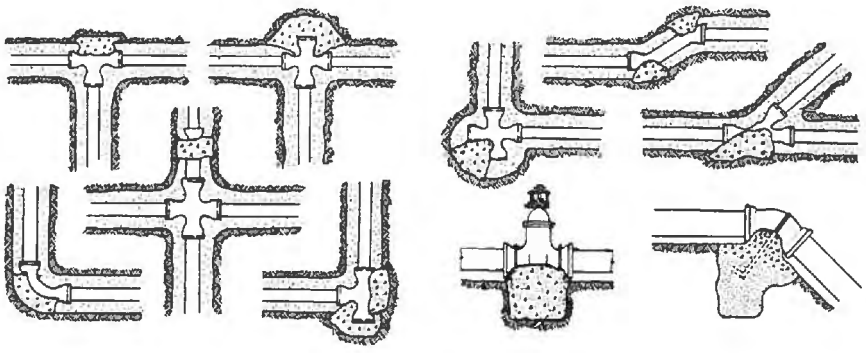
The Combination Air Valve combines the functions of both the Air/Vacuum and Air Release Valves and is an excellent choice for high points. A Combination Valve contains both a small release orifice and a large air/vacuum port in one assembly/



SINGLE BODY COMBINATION



Thrust Blocks & Anchors



THRUST BLOCKS and ANCHORS

添付資料 18 座学研修教材(給水)(テトン語版)

Design of Rural Water Supply System
(Planu ho sistema fornesementu Bee Mos iha Rural)

Lesson 1 Introduction(Lisaun 1 Introdusaun)

- WB's Rural Water Supply Manuals

  (Matadalan WB's ba fornesementu Bee mos)

- Water System Design Process

  (Dezenyu ba sistema ho prosesu ba bee mos)

- Outline of Water Supply System

  (Sistema liña jeral ba fornesementu bee mos)

RURAL WATER SUPPLY MANUALS

February 2012

The World Bank Office Manila

Volume I: DESIGN MANUAL

Volume II: CONSTRUCTION SUPERVISION MANUAL

Volume III: OPERATION AND MAINTENANCE MANUAL

RURAL WATER SYSTEM DESIGN PROCESS

(Prosesu Dizenya ho sistema fornesementu bee mos iha Rural)

1. **Service Level (level de Servisu)**
2. **Water Demand Projections(projetu baEzezensiais bee mos)**
3. **Facilities Designs (fasilidade de Dezenya)**
4. Capital Investment and O&M Costs (Kapital investemtu ho kustu O&M)
5. Tariff Design(Dezenyu de Tarifa)
6. Design Iteration(Interesaun dezenyu)
7. Plans and Design Specifications (Spesifiakasaun dezenyu ho Planu)

1. **Service Level (Level de servisu)**
   – The decision on service level or levels that the utility would provide should be based on a consultation process among the stakeholders.

(Desizaun ba level de servisu ka leveladu katak tenke utiliza konsultasaun tuir prosesu entre lideransa)

2. **Water Demand Projections (Kalkulasaun ba Ezezensiais Bee mos)**
   – It is necessary to determine the design horizon for which the facilities will be designed, and project the population to be served annually over this horizon, the unit consumptions, and expected non-revenue water.
   (Ne'e nesesidade nebe atu determina dezenya Horizon nian ba fasilidade nebe dezenya ba iha projetu populasaun nian iha annual de Horizon ba unidade konsumedores, hodi antisipada bee maran ka Laiha bee /NRW)

3. **Facilities Designs(Fasilidade Dezenya)**

4. Capital Investment and O&M Costs(Kapitalidade de Investimentu ho O&M)

–The planner/designer will have to estimate the O&M costs based on the details of the proposed system, its water source, and facilities.

-Planu/dezainer tenke iha kalkulasaun ba O&M bazia ba detailya custo nian husi sistema prosesu no fasilidade be matan

5. Tariff Design (Dezenya Tarifa)

6. Design Iteration (Dizenya Interasaun)

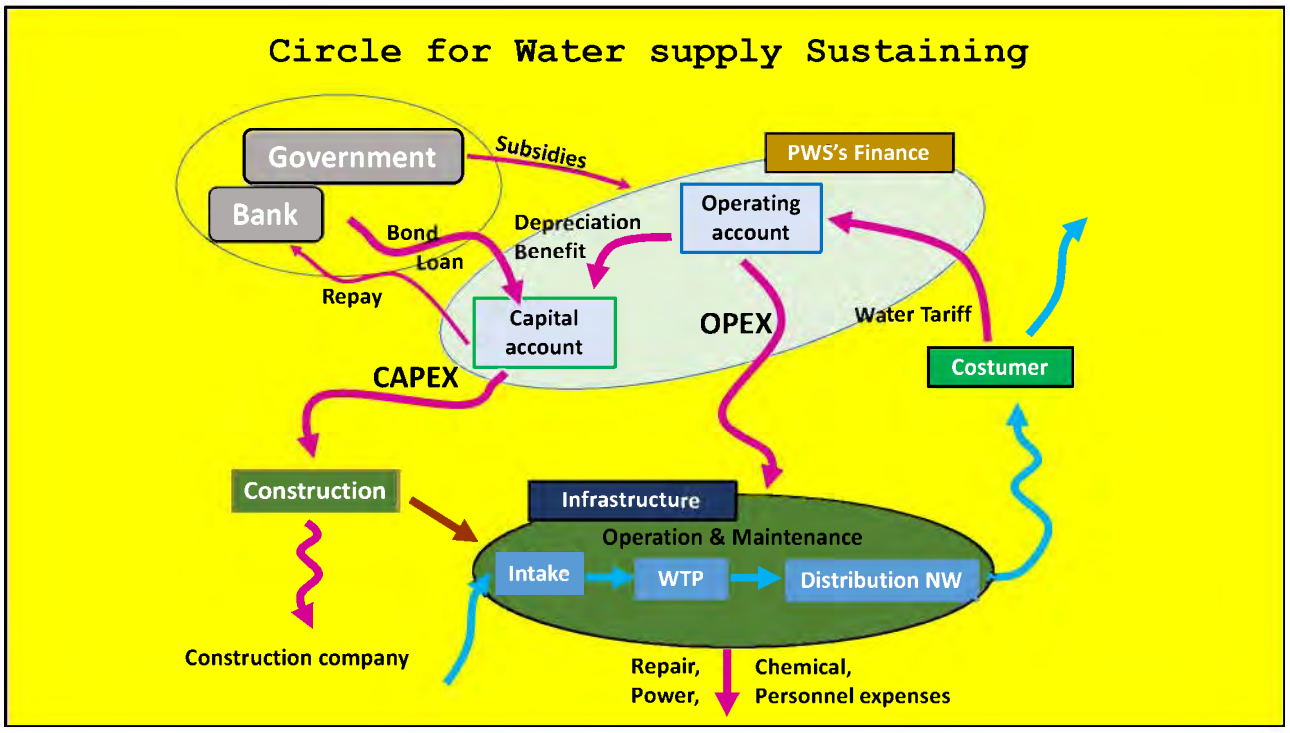
– Before plans are finalized, there is need to confirm if the facility, as proposed, meets the social criteria of affordability and acceptance.

-Antes finaliza planu ida ne'e, presiza mos konfirmasaun ba iha fasilidade,hanesan proposta, tuir kbi'it ho akordu kriteria sosial nian

7. Plans and Design Specifications (Spesifiku ho dizenya)

– Once all the agreements, design parameters, and assumptions are established, the detailed plans have to be prepared by professional engineers to ensure a well-balanced system that will fulfill its objectives, and to provide a detailed guide for the construction of the facilities.

-Akordu sira nebe tuir dezenyu parameter nian, iha mos klarifikasaun(dugaan) nebe stabelese, iha detalyu ba planu nian perparasaun ida ne'e husi enjineiru profisional sira hodi hatene liu tan ba sistema balansiu nebe diak katak, tenke tuir ka prense objetu sira atu perpara detalyu matadalan nian ba fasilidade kostrusaun.

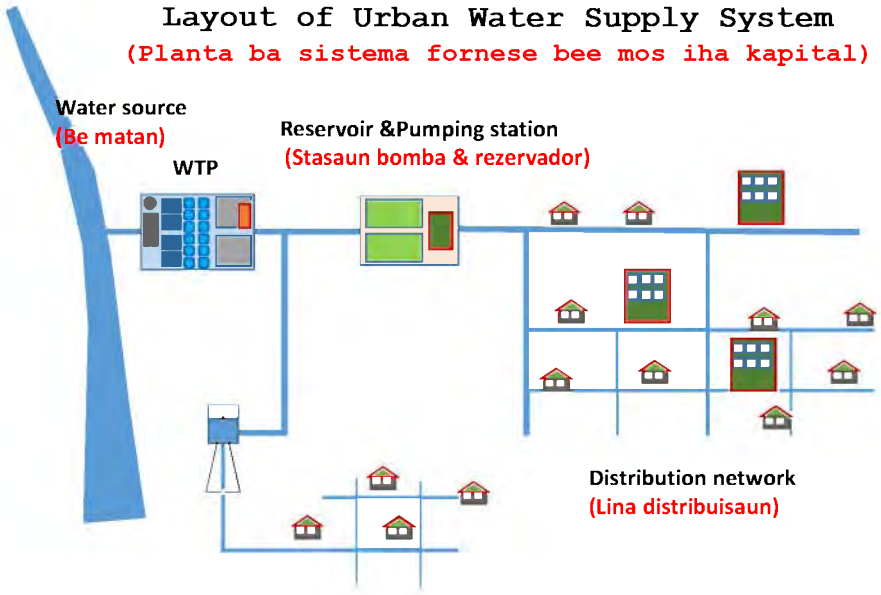


OUTLINE OF WATER SUPPLY SYSTEM

(DIZENYA BA SISTEMA FURNESE BEE MOS)

Layout of Urban Water Supply System

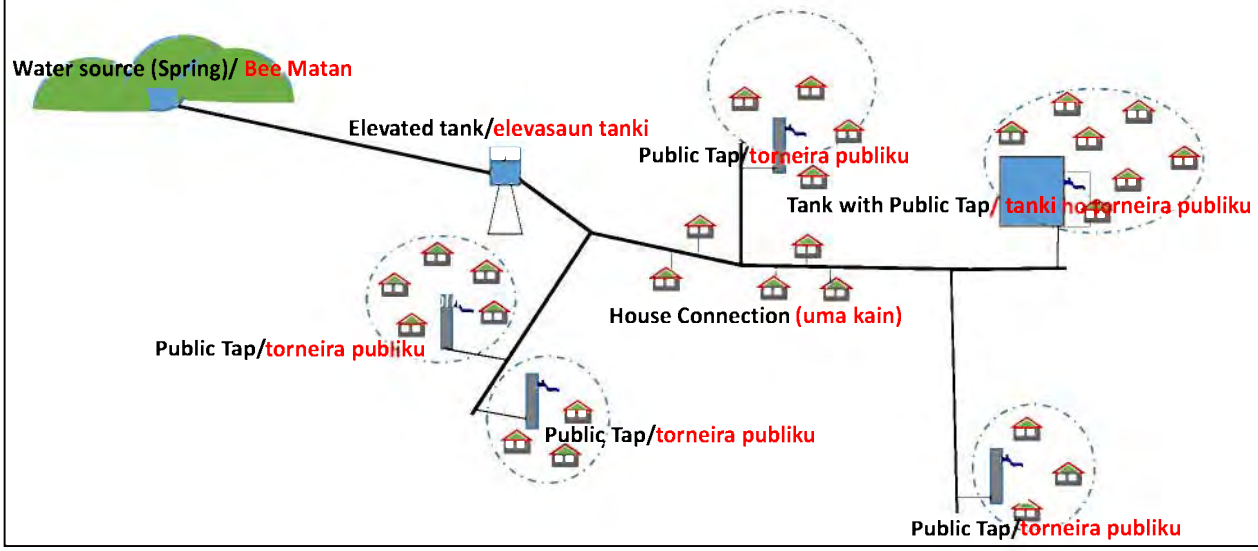
(Planta ba sistema fornese bee mos iha kapital)



3. Facilities Designs (Fasilidade Dizenya)

Layout of Rural Water Supply System

(Planta ho sistema fornese Bee Mos iha rural)



Component of Rural Water Supply System
(Komponenti ba Sistema fornese bee mos iha area rural)

1.Water source and Intake facilities
(Fasilidade inteik ho be matan)

2.Transmission main
(Transmisaun prinsipal)
3.Reservoir (Tank)
(Tanki)Rzervador
4.Distribution mains
(Distribuisaun Prinsipal)
5.Public taps or (and) Service pipe
Tonera Publiku & pipa distribudor

1. *Servisu Levelado*

Konsumidores ba bee mos per kapita = ?

Tornera Publiku ka uma kain = ?

- *Tornera barak ba iha uma kain*

100 l/c/d

50m (2.5min)

50 l/c/d

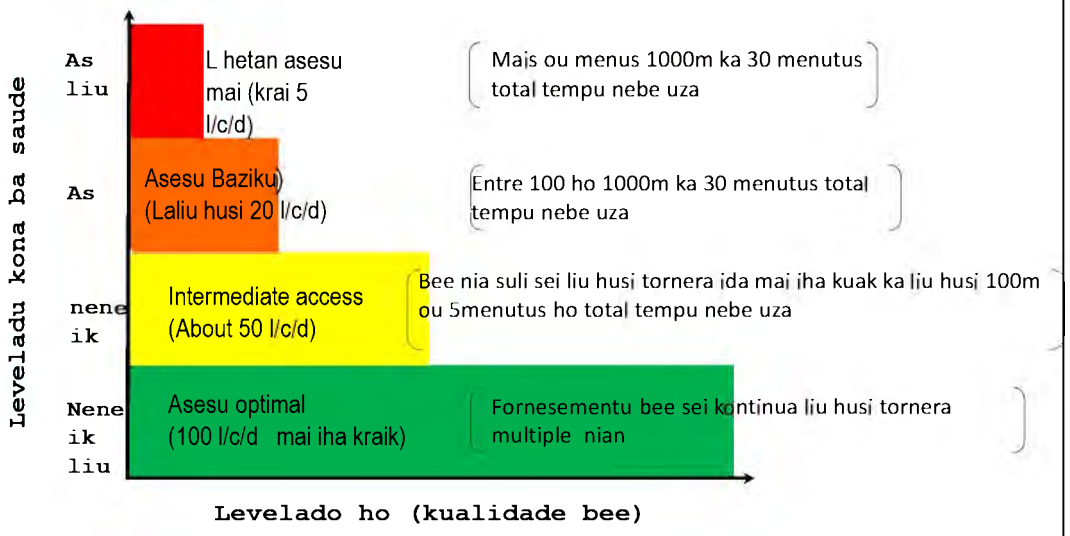
50m – 500m (2.5min - 15min)

20 l/c/d

500m (15min)

Below 5 l/c/d

Quantidade Bee Domestica ho Saude



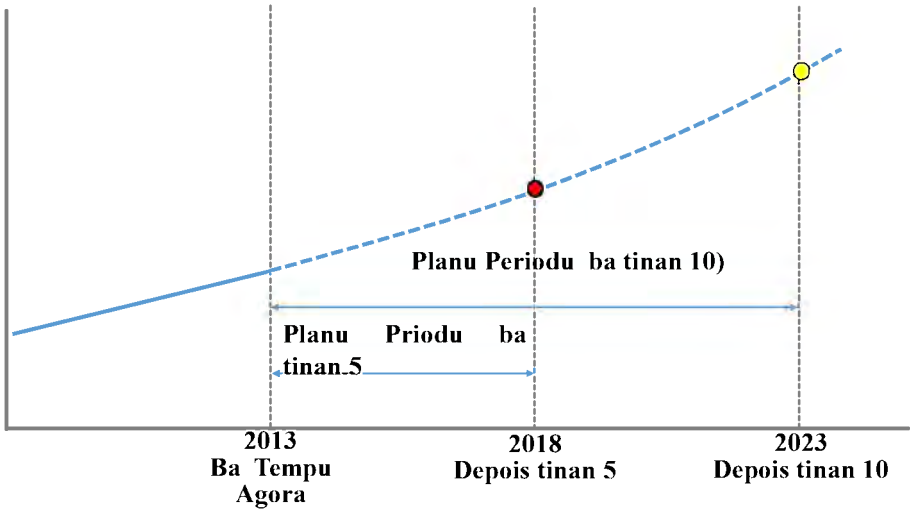
Lisaun 2. Ezezensia Bee Mos

- **Difinisaun servisu leveladu**
- ***Periodu Dizenya***
- ***Planu Populasaun***
- ***Bee ba Konsumidores***
- ***Bee maran ka laiha (*Non-Revenue Water /NRW)/**
- ***Ezezensia Bee Mos)***

Sumario reqerementu ba servisu leveladu atu promove saude

Levelado ba servisu	**Asesu medida**	Persiza hatene	**Persiza Leveladu nebe husi saude**
Laiha asesu (koletu kualidade sempre tun husi 5 l/c/d)	Mais ou menus1000m ka 30 total ba minutu nebe hetan husi oras nian	Konsume : sei lahetan -la iha konfiansa ba Hygiene(saude) – la iha mos posibilidade (karik tenke iha pratika husi bee matan)	As liu
Asesu iha Base (mediu ba kuantidade la liu husi 20 l/c/d)	Entre 100 ho 1000m ka 5 to'o minutes30 total ho tempu kalkulasaun nian	konsume – tenke konsume ba buat nebe mos (Hygiene) – hanesan fase liman hokobsume hahan nebe mos ka iha posibilidade hygiene nian; ropa nebe tenke mos/ ba haris nian kusta atu halo kalkulsaun ne'e la konta husi bee matan	As
Asesu Intermediata ba (mediu kuantidade nian hamutuk 50 l/c/d)	Bee sei liu hamutuk husi tornera ida (ka hamutuk 100m l ka menutu 5 ho total tempu kalkulasaun nian)	Konsume – asume husi Hygiene – ba pesoal sira seluk, ba hahan nebe mos (hygiene) hamutuk ho; bee fase ropa nian, bee hodi haris I tenke halo kalkulasaun ba iha ita nebe konsumi	kraik
Asesu optimal nian ho(Kuantidade mediu 100 l/c/d hare iha kraik iha krik)	Fornese bee mos liu husi tornera rin kaduak nian sei kontinua ba iha lina seluk	Konsume –ba nesesidade sira hotu tenke mos (Hygiene) – no mos ba nesesidade sira seluk	Kraik liu

2. Planu Periodu



	Vantajen	Desvantajen
Planu Periodu ba tinan lima	Kustu ba kapital nian nebe tun.	Sistema kapasidade nian atu aumenta ba iha kapaital foun nebe Persiza depois tinan lima(5)
Planu periodu ba tinan sanulu	Sistema fasilidade bee mos bele fornese iha ezezensia ba tempu naruk.	Kustu husi kapital nian nebe sa'e.

3. Planu Populasaun

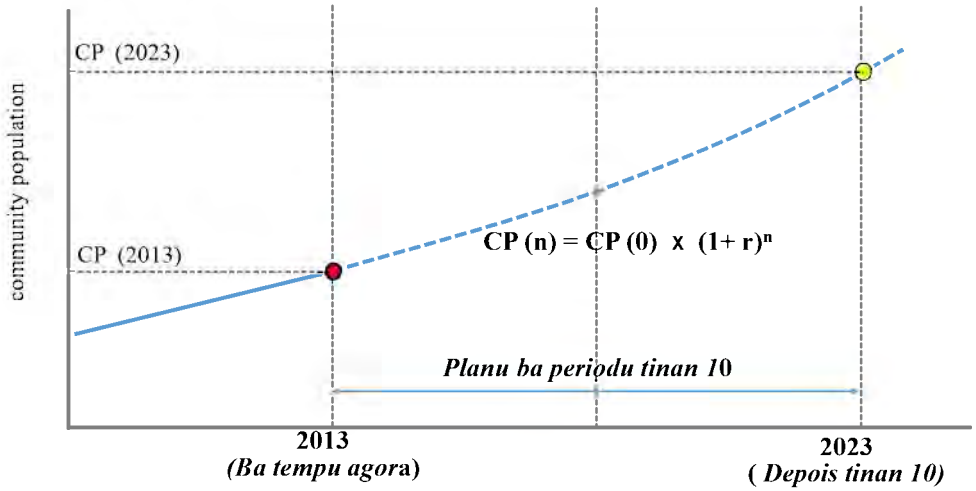
2 Planu populasaun iha projetu nia laran

- Kalkulasaun ba populasaun katak bele hetan husi bee matan (source)
- Projetu husi komunidade ba populasaun, ho potensial nebe determina iha area servisu hodi serve ba populasaun

$$CP\ (2023) = CP\ (2013)\ x\ (1+ r)^{n}$$

Iha

CP (2023) = Projetu husi komunidade ba populasaun iha 2013)
CP (2013) =(Komunidade ho populasaun nebe iha agora 2013)
r = kalkulasaun Annual nebe sae
n = Planu periodu ba tinan sanulu



4. Konsume Bee Mos

Iha area rural
Geralmente ba kosumedores sira iha limitadu ba populasaun nebe uza

- ***Hemu***
- ***Te'in***
- ***Hamos***
- ***Fase***
- ***Haris***

30 - 60 lpcd

Konsume husiInstituisaun: 1.0 m3/d
Konsume husi Komersial: 0.8 m3/d

5. Non Revenue Water (NRW) / Bee Maran ka La'iha bee

$$\text{NRW (\%)} = \frac{\textit{Mediu ba NRW}}{\textit{Sistema input Volume}} \text{ X } 100 \text{ (\%)}$$

NRW
Suli estraga
Uza ilegal

Sistema hatama volume
Mediu ba produtu bee mos ka distribui bee mos

6. Ezezensia Bee Mos

Ezezensia bee mos
Kalkulasaun husi konsumedores atu determina kapasidade nebe presiza husi Bee matan

Ezezensia be mos = Total Konsumidores + NRW

- Konsumi husi Uma kain
- Konsumi husi Instituisaun
- Konsumi husi Komersial

Variasaun Ezezensia ho faktoris Ezzensia

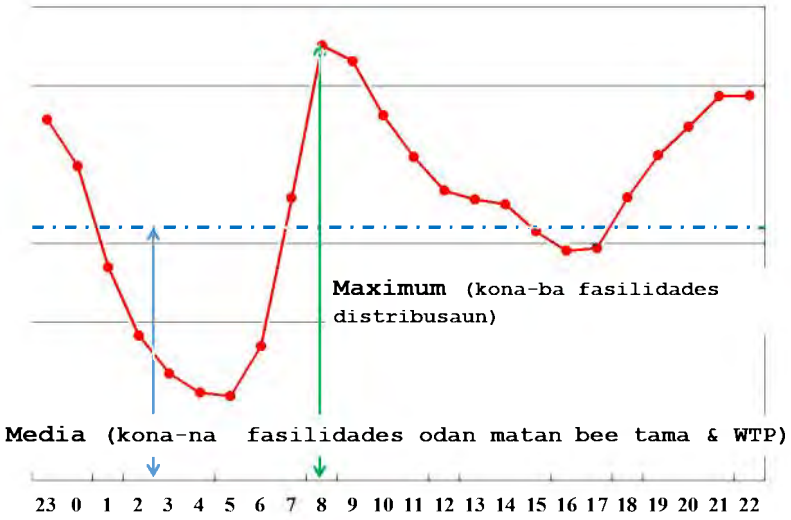
- **Minimum ezezensia ba loron ida**:
  The minimum amount of water required in a single day over a year.
  (Minimum ba kalkulasaun bee nian persiza loron ida ba tinan ida ia laran)

- ***Medio ba Ezezensia loron ida***
  Medio husi bee lor-loron nian persiza fornese ba iha tinan)

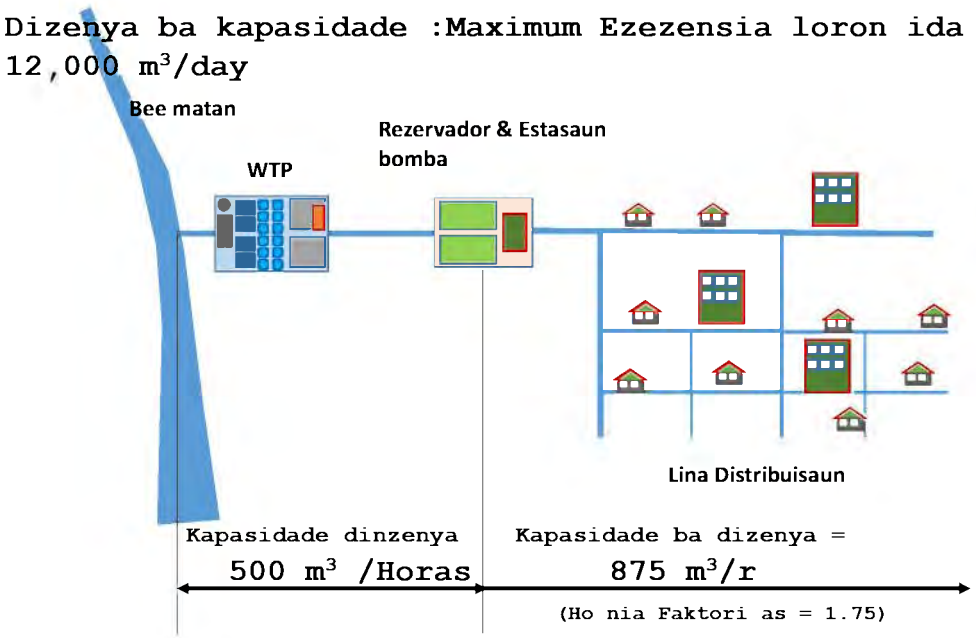
- ***Maximun ezezensia ba loron ida***
  Maximum ba kalkulasaun bee nian persiza loron ida ba tinan ida ia laran)

- **Ezezensia bee nia as kada oras**
  Ezezensia ba bee nia as loron ida

Ezezensia bee mos nia as kada oras iha maximun loron ida



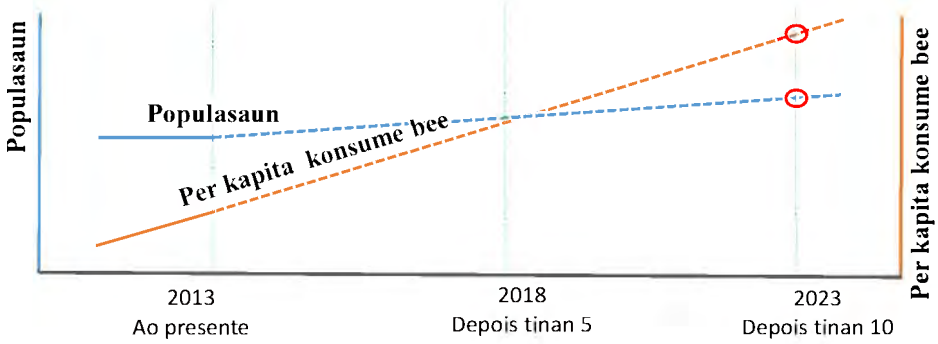
Dizenya ba kapasidade :Maximum Ezezensia loron ida = 12,000 m^3/day



Ezeznsia bee mos= per kapita ba konsume bee x populasaun + NRW

Estimsaun ba ezeznsia bee mos= Target ba ezezensia bee mos kada Tinan

Ezemplu : Target ba Tinan nian= depois tinan 10



Planu ho Fasilidae Ezezensia Bee Mos

Ezemplu: Comunidade A

Uma kain (HHs) = 100, medio 1 HH = Ema nain 6
Total Populasaun nebe Uza = 100 x 6 = 600
Medio ba Ezezensia Bee mos = 600 x 50 lpcd = 30,000 l/d

NRW (Leakage ratio/reasaun estragus) = 15 %
Total ba distribui inklui mos estragus
= 30,000 l/d / (1 – 0.15) / 86400 sec/d = 0.41 l/sec
Maximum Ezezensia Bee
= Medio ba Ezenzensia Bee (inclui NRW) x 1.30
= 0.41 l/sec x 1.30 = 0.53 l/sec

Reference Multi-Suco halibur/menghimpun iha projetu Indonezia
Manual kona-ba komunidade-Bazeia organizasaun fornese bee.

Outubro 2011

Estimasaun Kuantidade ba ezezensia Bee

Mutivasaun ba Principais kona ba istimasaun

Regulasaun numeru 18/2007 husi Ministerio Obras Publik kona ba jestaun katak projetu ba bee nebe persiza ba planu periodu tinan 15, iha intervalu ba tinan 5- nia laran. Ne'e necesari tebes atu halo kalkulasaun ema nain hira mak uza ka serbi ba intervalu ba planu periodu ne'e.

- Sistema komponentis diferensa persiza atu habelar/ dezenvolve durante tina 5, haktuir mai ne'e ba parte kona ba projetu Ezeznsia Bee mos nian:
  - O Bee iha intake – 130% Total volume kona ba bee nebe persiza ba loron ida nia laran
  - O Tratamentu ba Bee – 120% Total volume kona ba bee nebe persiza ba loron ida nia laran
  - O Distribuisaun bee – 100% Total volume kona ba bee nebe persiza kona ba ezezensia kada horas ba loron ida
- Sistema distribuisaun ezezensia bee mos ,tenki bazeia ba volume nebe as tuir oras, la os katak media durante loron ida. Refere ba loron ida oras ba oras durante loron ida volulme nebee uza bee as tebes tamba simulatasaun tuir uza nian .Ba oras atual bainhira ezezensia bee mos nee as tebes tenke observa husi preprasaun bee, maibe hanesan bain-bain durante oras bee suli mak:: 06.00- 09.00, 12.00-14.00 and 17.00-19.00

Profile konsumedor (1)

Type of Customers	Total Number of Customers	Average Consumption	Annual Consumption	% of Total Annual Water Consumption
1. House connections	300 households x 4 persons = **1,200 persons**	50 liters per capita per day x 365 days	21,900 m^3	85%
2. Stand pipes	2 standpipes x 20 households x 4 persons = **120 persons**	20 liters per capita per day x 365 days	876 m^3	4%
3. Water-using businesses, including restaurants, laundry and clinics	2 establishments x 10 visitors = **20 visitors**	100 liters per visitor per day x 365 days	730 m^3	3%
4. Non-water using businesses, such as offices	2 establishments x 10 employees = **20 employees**	20 liters per employee per day x 20 days x 12 months	96 m^3	0.5%

Profile Konsumedor (2)

5. School	1 elementary school x 6 levels x 35 students = 210 students	20 liters per student per day x 20 days x 10 months	840 m^3	3.3%
6. Mosque	1 mosque x 210 visitors per week / 7 days = 30 visitors	20 liters per visitor per day x 365 days	219 m^3	.09%
7. Public Market	1 market x 20 stalls = 20 stalls	200 liters per stall per day x 2 days x 12 months	96 m^3	.05%
8. Livestock - cow	40 heads	30 liters per head per day x 365 days	438 m^3	1.7%
9. Livestock - goat	40 heads	20 liters per head per day x 365 days	292 m^3	1.1%
Total Annual Water Consumption			*25,487 m^3*	*100%*

Profile ba Kosumedor (3)

Additional Provision for:				
10. Fire fighting, system flushing and other public uses			1,275 m^3	5% of 25,487 m^3
11. Water losses			5,100 m^3	20% of 25,487 m^3
Total Water Needs			**31,862 m^3**	

Lisaun 3: Bee Matan

1.Klasifikasaun husi bee matan

2. Sasukat kapasidade ba bee matan

3. Protesaun ba bee matan

1. Klasifikasaun husi bee matan

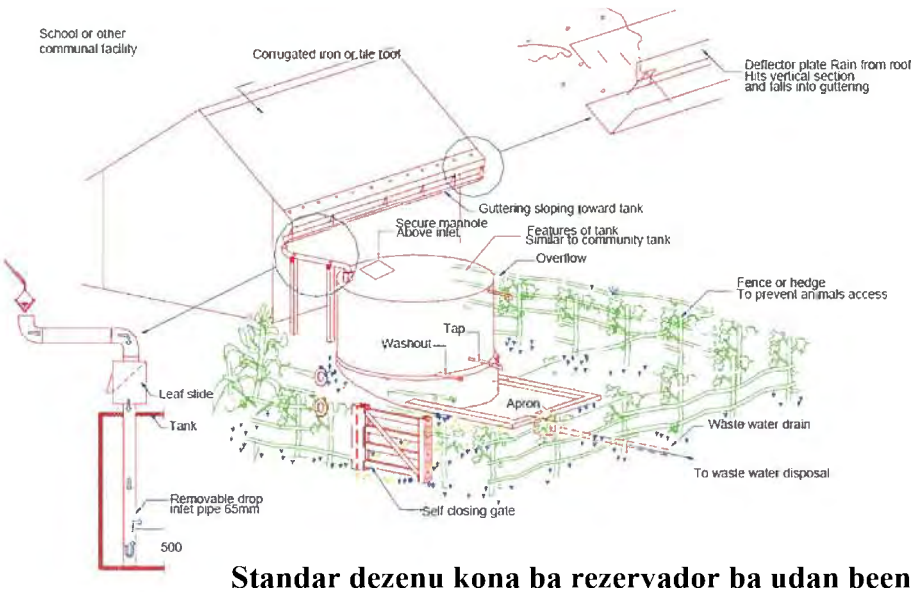
- Udan Been
- **Fontanario**
- **Infiltrasaun bee posu (bee mota foer)**
- **Bee rai okos**
- Bee rai leten

Selesaun bee matan kona-ba bee matak

Karistika ho Faktores ba iha konsedarasun	Spring/Fontenario	Bee rai okos (posu)	Surfei ma iha (Ponds, lakes, mota, etc.)
Kualidade Bee	Sempre modera satisfeto	Sempre satisfeitu	Sempre minus husi satisfeitu
Preasaun ba bee matan husi Polusi	Filtrasaun lokal kona-ba fase/soe, diak hanesan husi animal sira han du'ut haleu bee matan horis. Hale'u lutu ba area bee matan horiis hodi proteje kaixa fontenari nian.	hare ba pagina iha kraink katak konsedera hanesan husi septinasaun besik nia tanke ka fatin foer nian. Lokasi bee posu mais ou menus 10 metrus husi dalan atu terinfeksi ba tanki	Distribuisaunn liu ka hakat husi area be matan ho mos husi area seluk. Geralmente providu ka regula kontaminasaun ba iha distribui bee .
Tratamentu	Presiza filtrasaun ho eimentasaun atu haketak husi raihenek ka liuliu mak tahu. Dala ruma presiza disenfeksaun	Dala ruma persiza desinfeinfeksaun(pembaha smi Kuman)	Dalaruma persiza sedimentasaun , filtrasaun ho infeksaun ba minimum. Seluk tan bele mos presiza prosesu de tratamentu.
Esperensia ka skill atu Manaje produsaun	Neneik	Moderate/moderator	Moderato ba as tebes.
Uza Energi hodi dada	Naturalidade gravidade bee rai leten.	Bomba hodi suspa bee.	Diversaun ba intake dala ruma la husu ka dada husi bomba
Bee suli controlu de cheia	Importantes tebes parte nebe atu aloka kona-ba kolekta estrukture/konstrusaun(e.g. bee dalan tama) husi dalancheia.		Parti importante mak halo estutura (e.g. inlet chamber) dok ka sai husi bee sulin ho kontrolo de cheia

Multi-Village Pooling Project in Indonesia Handbook for Community- Based Water Supply Organizations

(1) Udan Been

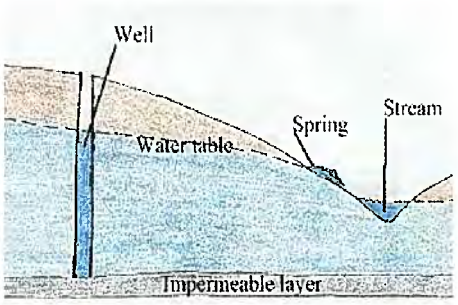


Standar dezenu kona ba rezervador ba udan been

(2) Fontenario

<u>*Bee rai okos ha ses'an husi ai horis*</u>
(ex. Hanesan mosu iha-)

- Bee iha ku'ak ki'ik oan
- Bee bokon husi foho tutun



<u>*Atu obtain satisfetu ba bee*</u>

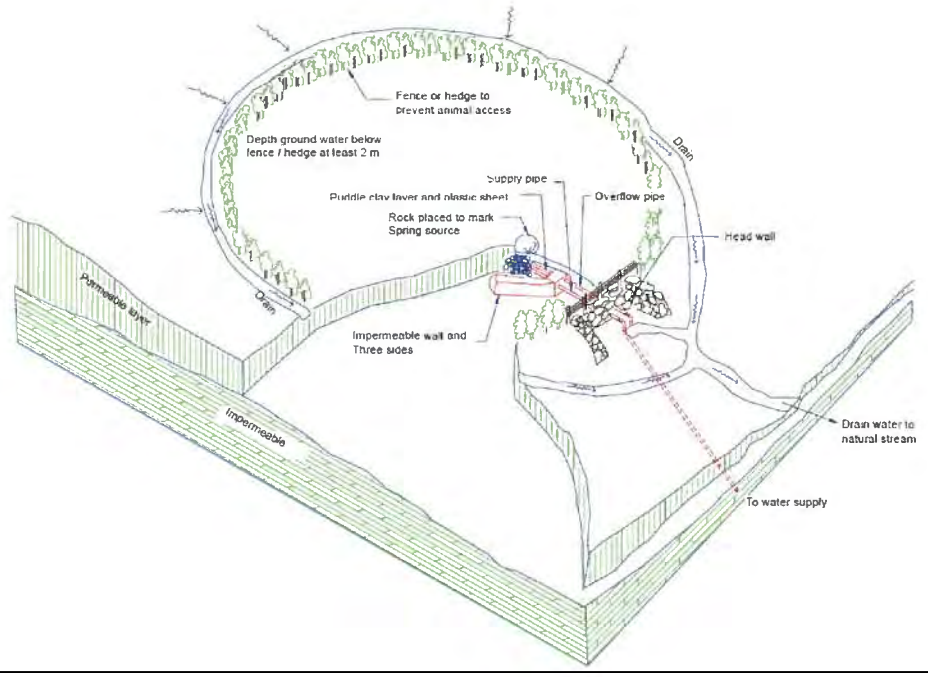
- Eliminasaun surpevesien ba tentasaun bee
- Prevene animal sira hosi asesu fontinario nian
- La iha imediatasaun ba iha bee ulun nia fatin

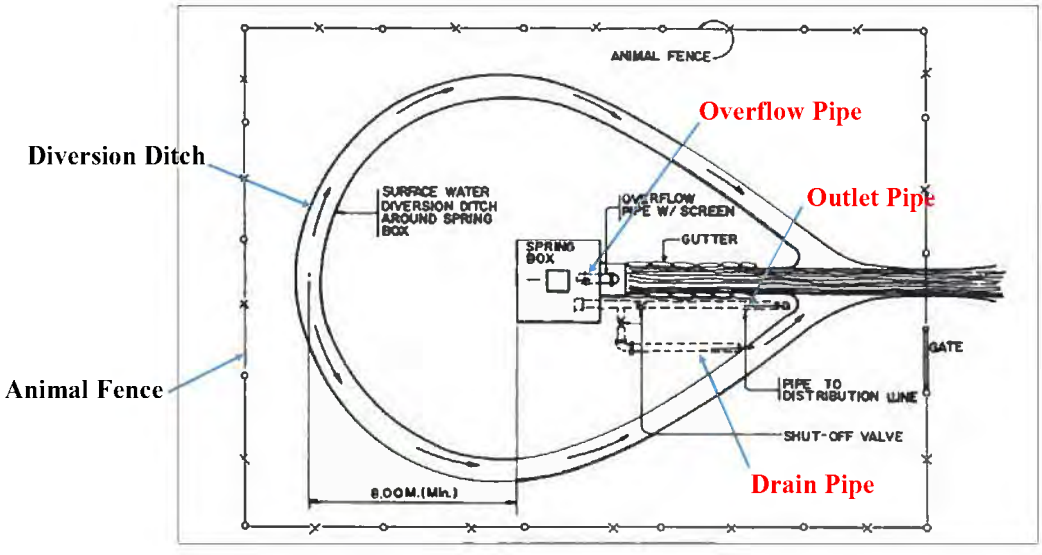
Tenki iha Fontanario

- Tenki proteze husi polusi ba bee ulun
- Tenki iha tampaun hodi taka bee
- Tenki obtain husi gravita nia sasulin
- Tenki iha inspesaun manholes nian

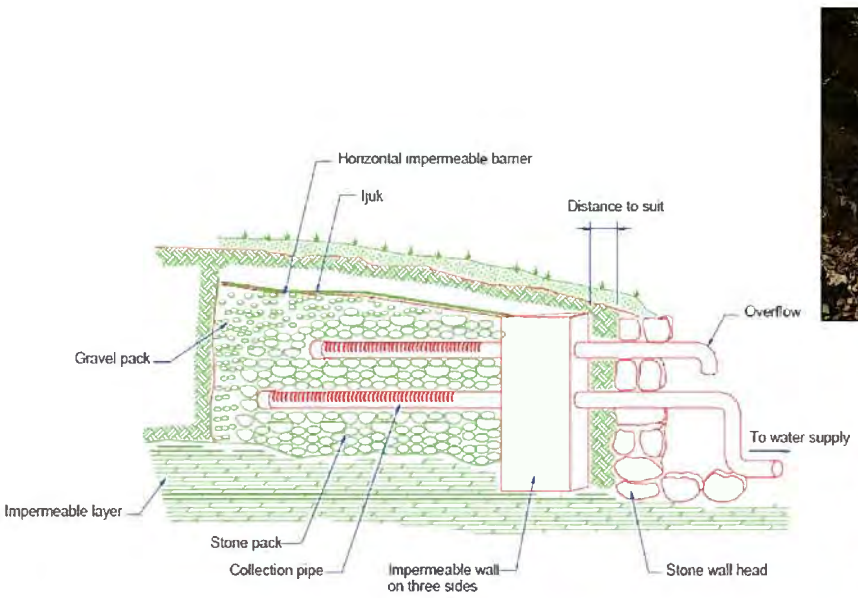
(tenki taka ka savi)

Fasilidade Intake husi fontinario

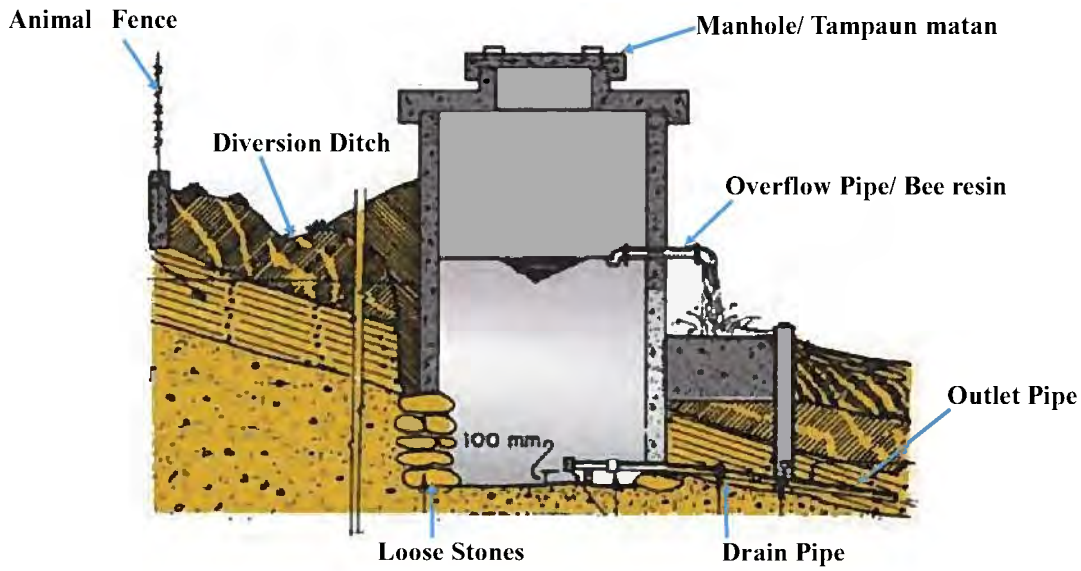




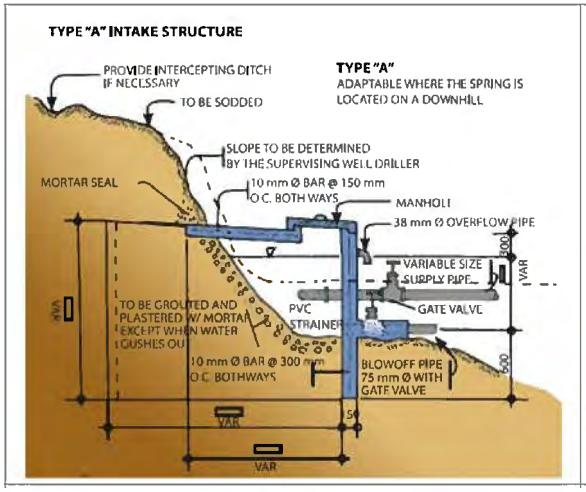
- Ground Plan -

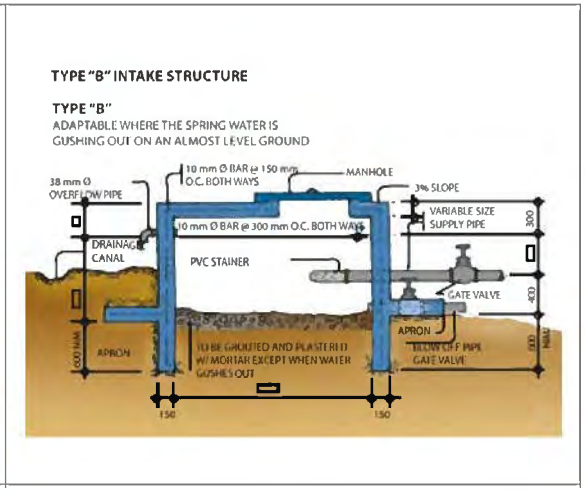


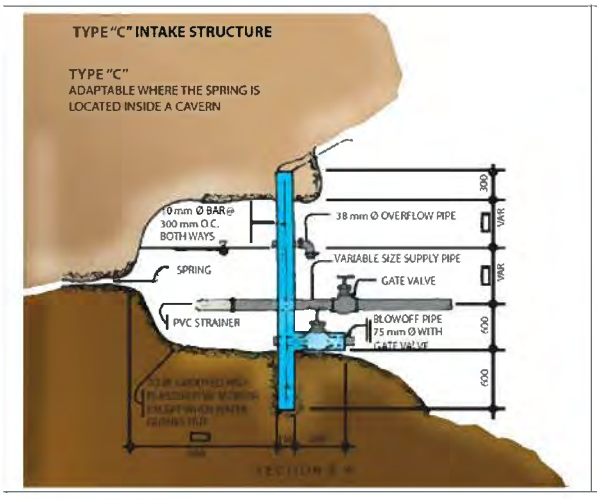
Dizenya Baziku be Featuras husi Kaisa Fontinario

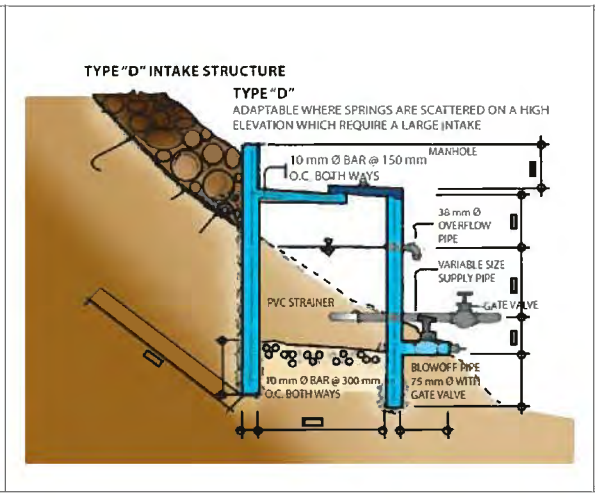


- Sectioned Drawing -

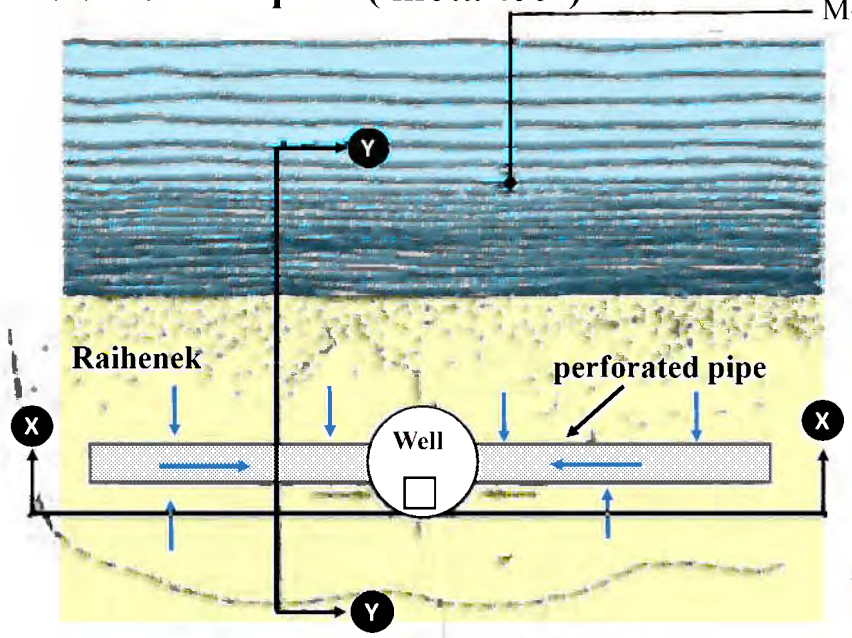

TYPE "A" INTAKE STRUCTURE
PROVIDE INTERCEPTING DITCH IF NECESSARY
TO BE SODDED
TYPE "A"
ADAPTABLE WHERE THE SPRING IS LOCATED ON A DOWNHILL
SLOPE TO BE DETERMINED BY THE SUPERVISING WELL DRILLER
MORTAR SEAL
10 mm Ø BAR @ 150 mm O.C. BOTH WAYS
MANHOLE
38 mm Ø OVERFLOW PIPE
VARIABLE SIZE SUPPLY PIPE
GATE VALVE
PVC STRAINER
TO BE GROUTED AND PLASTERED W/ MORTAR EXCEPT WHEN WATER GUSHES OUT
10 mm Ø BAR @ 300 mm O.C. BOTHWAYS
BLOWOFF PIPE 75 mm Ø WITH GATE VALVE
VAR

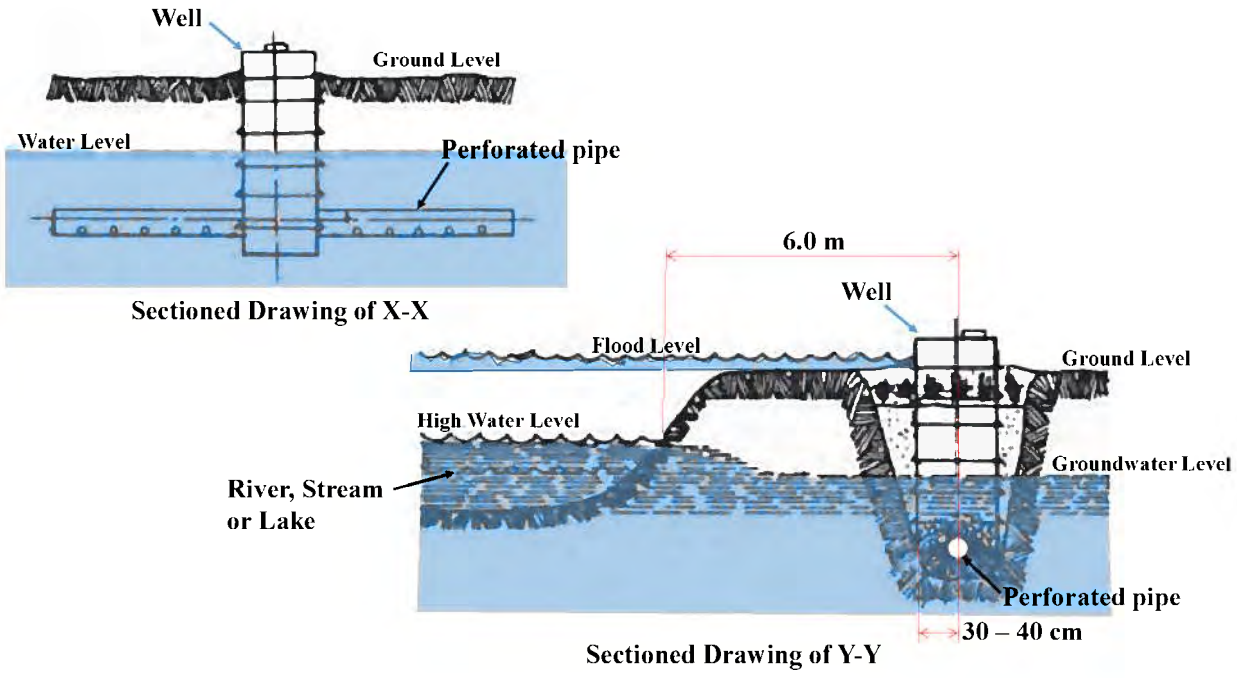

TYPE "B" INTAKE STRUCTURE
TYPE "B"
ADAPTABLE WHERE THE SPRING WATER IS GUSHING OUT ON AN ALMOST LEVEL GROUND
38 mm Ø OVERFLOW PIPE
10 mm Ø BAR @ 150 mm O.C. BOTH WAYS
MANHOLE
3% SLOPE
VARIABLE SIZE SUPPLY PIPE
10 mm Ø BAR @ 300 mm O.C. BOTH WAYS
DRAINAGE CANAL
PVC STAINER
GATE VALVE
APRON
TO BE GROUTED AND PLASTERED W/ MORTAR EXCEPT WHEN WATER GUSHES OUT
BLOWOFF PIPE
GATE VALVE

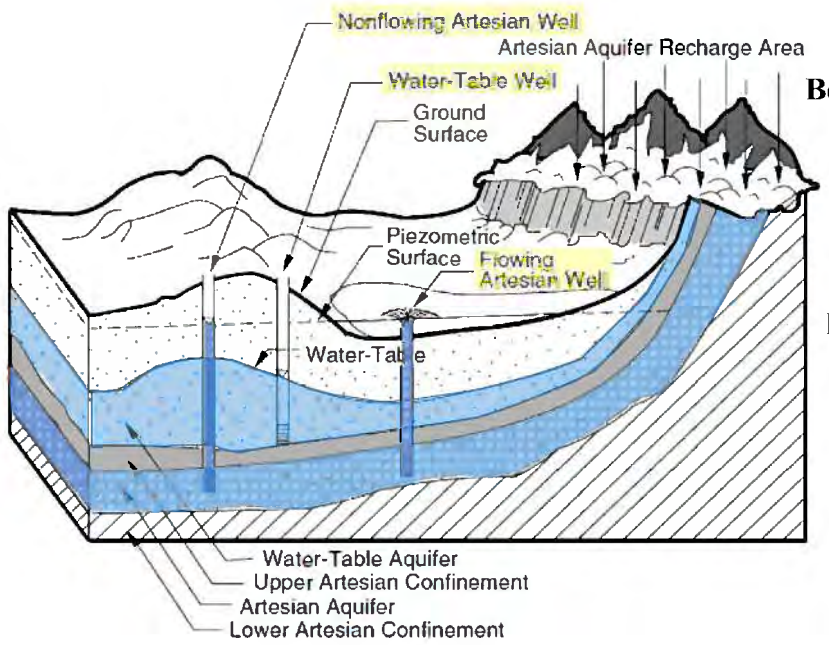

TYPE "C" INTAKE STRUCTURE
TYPE "C"
ADAPTABLE WHERE THE SPRING IS LOCATED INSIDE A CAVERN
10 mm Ø BAR @ 300 mm O.C. BOTH WAYS
38 mm Ø OVERFLOW PIPE
VARIABLE SIZE SUPPLY PIPE
SPRING
GATE VALVE
PVC STRAINER
BLOWOFF PIPE 75 mm Ø WITH GATE VALVE


TYPE "D" INTAKE STRUCTURE
TYPE "D"
ADAPTABLE WHERE SPRINGS ARE SCATTERED ON A HIGH ELEVATION WHICH REQUIRE A LARGE INTAKE
10 mm Ø BAR @ 150 mm O.C. BOTH WAYS
MANHOLE
38 mm Ø OVERFLOW PIPE
VARIABLE SIZE SUPPLY PIPE
PVC STRAINER
GATE VALVE
10 mm Ø BAR @ 300 mm O.C. BOTH WAYS
BLOWOFF PIPE 75 mm Ø WITH GATE VALVE

(3) Infiltrasaun bee posu (mota foer)







Bee-Tabela bee possu
- **Posu la dun kle'an**
- **Possu nebe kle'an**

Fura bee posu(Sumur bor)
- **La sulin /Maran Fura bee posu**
- **Sulin/be e barak Artesian Well**

(4) Bee rai okos

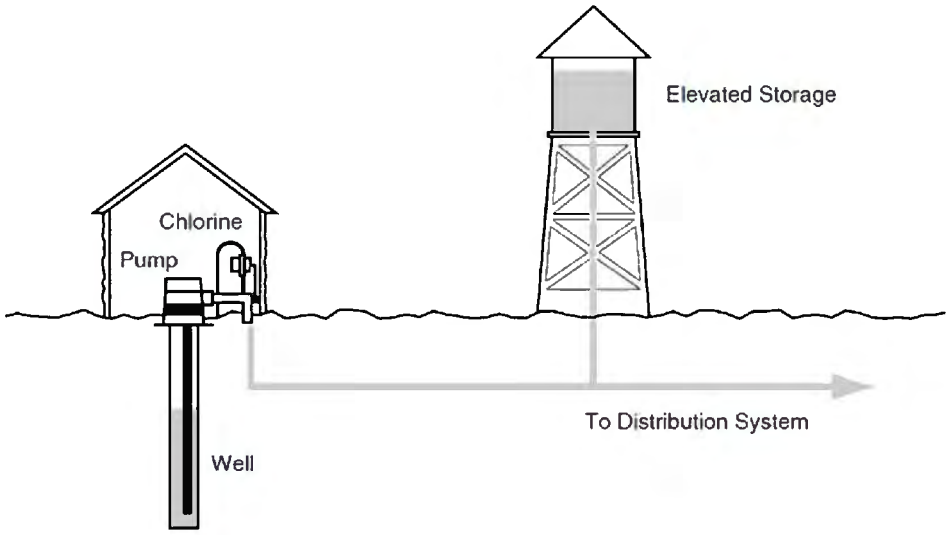
Klasifikasaun ba bee posu bazeia ba Aquifer Tapped

1. **Bee posu la klean**
   - Nia klean minus husi 20 metrus
   - Nia luan depende husi tempu udan monu rai

2. **Bee posu nia klean**
   -Nia klean liu husi metro 20
   - La hetan konfiansa husi ninia dalas fatin hodi laborus(tidak bisa ditembus)

3. **Fura bee posu (Sumur bor)**
   -Husi aquifer bele hamenus entre material liu husi dalas nian hodi borus (rai belit,fatu isin)

Ezemplu sistema bee matan



kestaun Arsenic

(5) Bee iha rai leten

- Inklui mos bee husi mota oan, mota, lagoa(danau), debu(be lihun), tasi ho oceano(samudra)
- Kontaminasaun minerals organik ho inorganik
- Persiza aseguru ba tratamentu be nian
- Tenke ha-ses ka ha-dok husi fornesementu bee rural nian

2. Source Capacity Measurements

Sasukat kona ba volume bee

a. Metodu Volume metrika

b. Uza metodu bee sasulin ho V-Notch Weir

c. Bee fo'er-ho Metodu rate nian

a. Metodu Volume-metrika

Data:

Volume of oil drum used : 200 liters

Number of drums used : 1

Time to fill the drum : 30 seconds

Required: Well yield

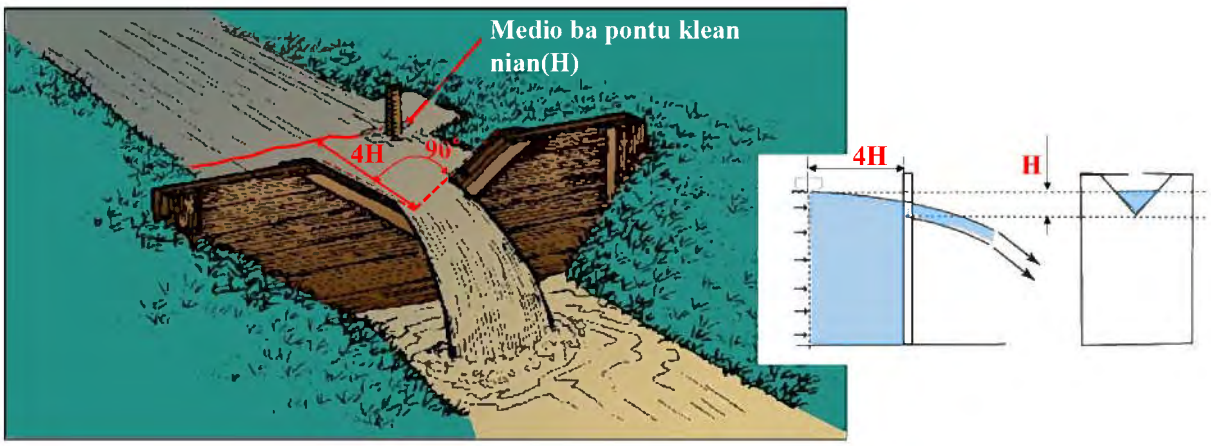
1. **Calculate the total volume of water collected, V**

$$V = Volume\ of\ container\ used = 200\ liters$$

2. **Calculate the yield of well, Q**

$$Q = \frac{Volume\ of\ water\ collected}{time\ in\ seconds} = \frac{200\ l}{30\ s} = 6.67\ lps$$

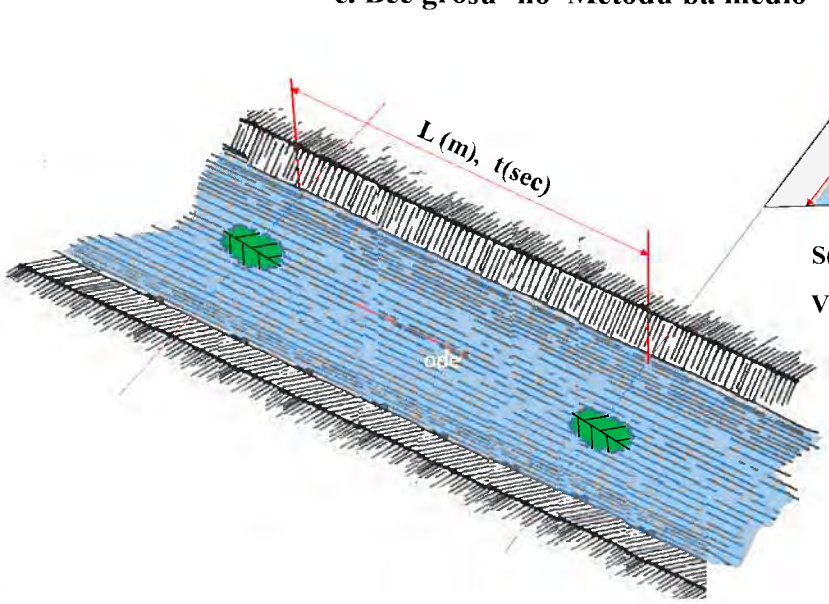
b. Uza metodu ba sasulin bee V- Norte



60° : Q = 0.008 x $H^{2.5}$

90° : Q = 0.0138 x $H^{2.5}$ **Q : l/sec, H : cm**

c. Bee grosu- ho Metodu ba medio



$S(m^2) = (W1+W2) \times ½ \times D$

$V(m/sec) = L/t$

$Q(m^3/sec) = V \times S$

3. Protesaun ba Bee matan

Iha sistema bee hemu nian, kona ba protesaun bee matan hanesan kritikal ida ka pasu ida ba oin atu ivita no proteze kontaminasaun bee hemu nian nomos tenke hasa'e kualidade husi bee matan rasik

Wain hira bee matan Monu ka estragus, iha opsaun hirak ne,e:

(1) Muda ka troka bee matan fatin

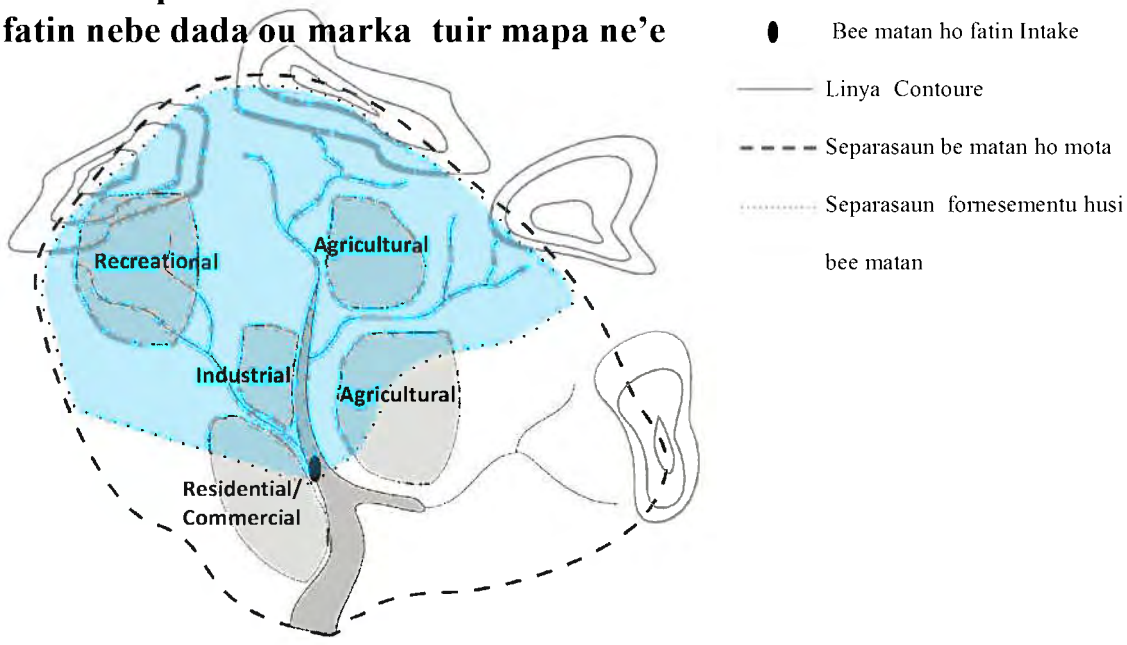
(2) Hamos ka halo instalasaun ba bee tuir sistema saudi nian

(3) Hamos ka muda foer husi bee matan

Polusi husi bee matan prinsipal

Bee matan ba populasaun	Posibilidade Kontaminasaun
Fo'er nakonu tama husi rai	Todan aluminium nian, chloride, sodium, Kompletu ho mistura organika & inorganika
Liquidu foer nian tama ba iha debu/ lagoa	Todan aluminium, hosi solvente ho bee masin
Tanke infeksaun/ Filtrusaun husi natureza	Organika solvente nian, nitrat(Garam), sulfat , microbiological ho kontaminasaun
Aktividade Agrikultura	Nitrat (garam), herbicida ho pesticida
Infiltrasaun lala'o ho diak	Produtu petroliu mistura inorganika , ho todan alminium nian

Geralmente sempre uza ba iha rai nebe halo sosiliza ona ba be nia fatin nebe dada ou marka tuir mapa ne'e



Lisaun 4 tratamentu kona-ba bee

Tenki prevene tratamentu kona-ba bee ideal duni .

Se-diak liu tan halo selesaun ba bee matan no kualidade atu hahu hamenus fasilidade ho kustu operasaun.

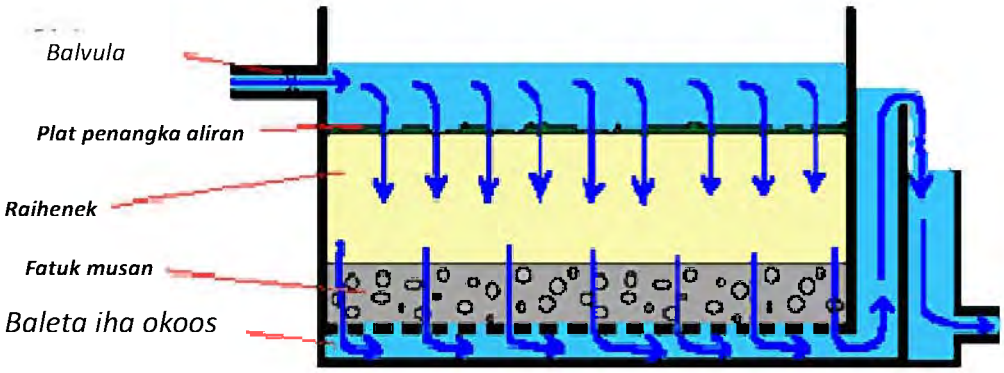
- **Filtrasaun raihenek neneik.**
- **Filtrasaun raihenek lalais.**
- **Desinfeksaun**
- **Kazu Altona**

Filtrasaun Raihenek neneik vs Filtrasaun Raihenek Lalais

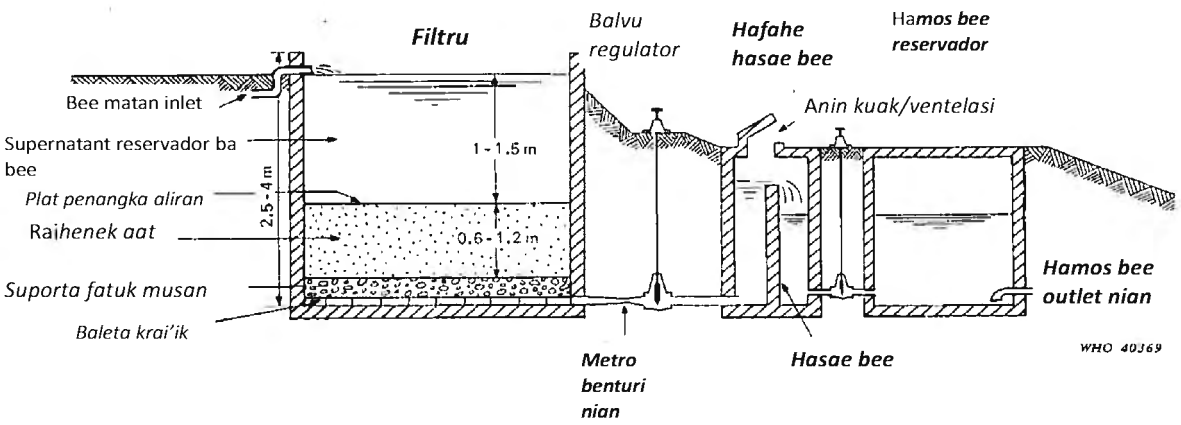
Sasukat filtrasaun 4 - 6 m/loron ida	**120 – 150 m/loron ida**
Kekeruhan/ foer(Turbidity) iha krai'ik 20 ntu	**iha krai'ik 1000 – 2000 ntu**
Bee matak	

Pre-tratmentu: la'iha/ sedimentasaun Koagulasaun(pembekuan), flokulasaun, Sedimentasaun

Filtru raihenek neneik



Filtrasaun raihenek neneik



Kazu Altona : Cholera outbreak iha Hamburg, Germany iha tinan 1892/

- *Outbreak ba Cholera luan(boot) iha Hamburg*
- *Kazu 17,000; mortalidade 8,600*
- *Kazu balun filtra fornese bee husi vizinho nebe serbi ba Altona*
- *Baleta soe bee foer nebe iha bee ulun husi intake Altona.*

Filtrasaun Raihenek lalais

Koagulasaun/Coagulation (Pembekuan) flokulasaun

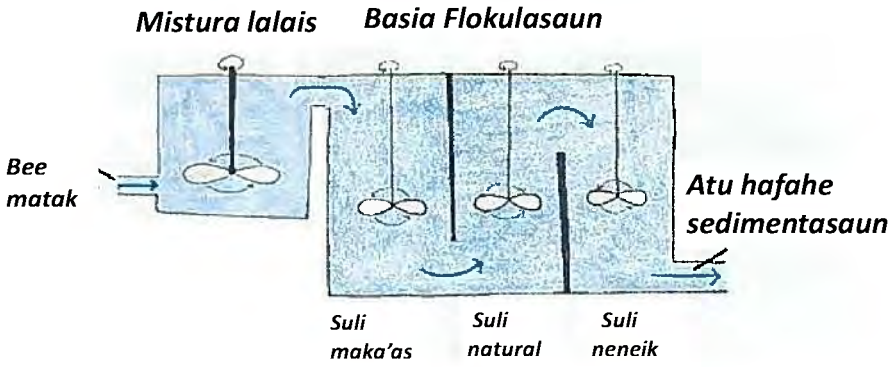
↓

Sedimentasaun

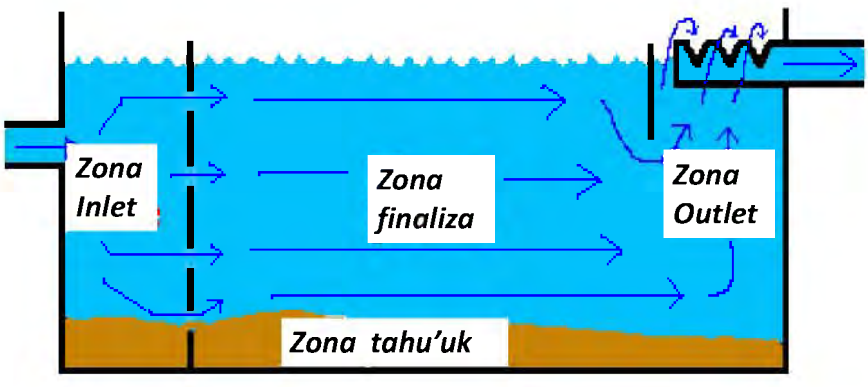
↓

Filtru Raihenek Lalais

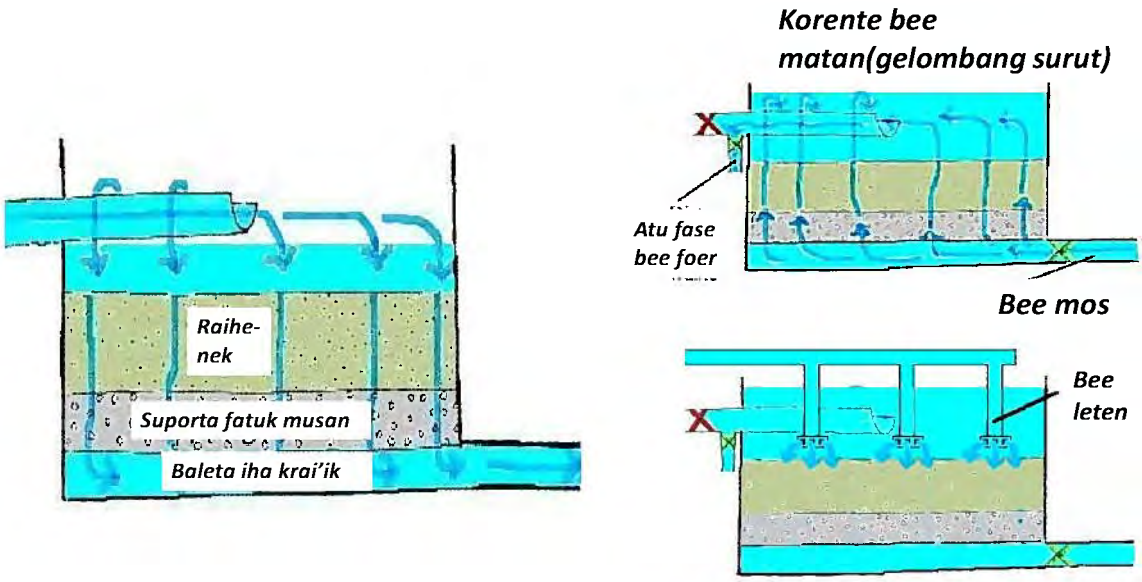
Koagulasaun(pembekuan) ho Flokulasaun



Sedimentasaun



Filtru Raihenek Lalais



Desinfeksaun

1. **Desinfeksaun bee: kona-ba atu muda, diaktivasaunn ou hamate pathogenic microorganismu.**

2. **Garantia atu hemu bee nee livre husi moras microorganismu.**

Sistema distribusaun bee desinfeksaun nebee sempre publikamente husi servisu nain ,karik bee matak bele hemu sasukat kontrola distribusaun bee atu prevene moras transmitida husi bee.

Gas Chlorine

Chlorine + Bee ⟶ **Hypochlorous Acid + Hydrochloric Acid**

$Cl_2 + H_2O$ ⟶ **HOCl + HCl**

Hypochlorites

Sodium hypochlorite (NaOCl)

Sodium hypochlorite + Bee ⟶ **Hypochlorous Acid + Sodium Hydroxide**

$NaOCl + H_2O$ ⟶ **HOCl + NaOH**

Calcium hypochlorite ($Ca(OCl)^2$)

Calcium hypochlorite + Water ⟶ **Hypochlorous Acid + Calcium Hydroxide**

$Ca(OCl)_2 + 2\ H_2O$ ⟶ **2 HOCl + $Ca(OH)_2$**

Lisaun 5: Sistema Transmisaun no Distribuisaun

- Transmisaun ho Sistema Distribuisaun)
- Liña Pipa Hydroliku
- Kriteria Dizeñu Liña pipa)
- Selasaun Material ba Liña Pipa)
- Apurtenense ba transmisaun ho distribuisaun iha fatin Prinsipal)
- Tornera Publiku/ ligasaun servisu)

1. Sistema Transmisaun ho Distribuisaun

(1) Liu husi grafitasi nia sulin

Montagen ne ideal, I wainhira fatin bee Matan nian kensedera ka sente elevasaun nian as , area ne mos Serve (bele uza)

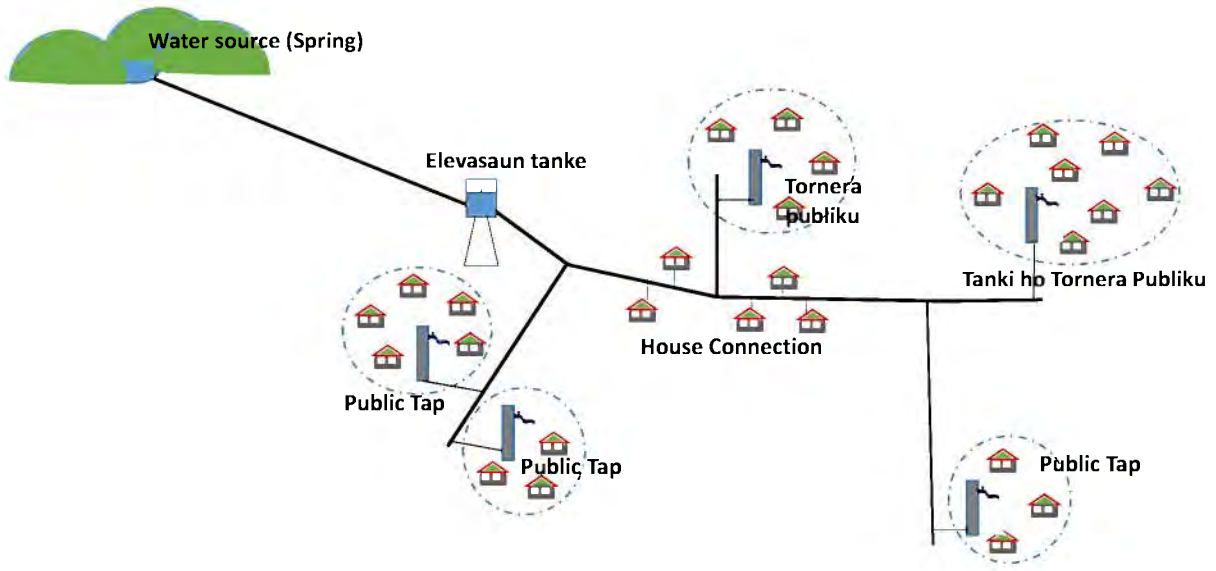
(2) Liu husi Bomba /bee ho Tanki rezervador

Water is either (a)Husi bomba(Bee) ba iha rede pipa distribui nian,hafoin ba konsumedores, ho bee nia resin sei ense ba iha tanki rezerva, (b)Dahuluk bomba(Bee)sei ense ba iha tanki rezerva,i Bee distribui liu husi Gravidadi sei tama(ense) ba Tanki hafoin ba iha konsumedores

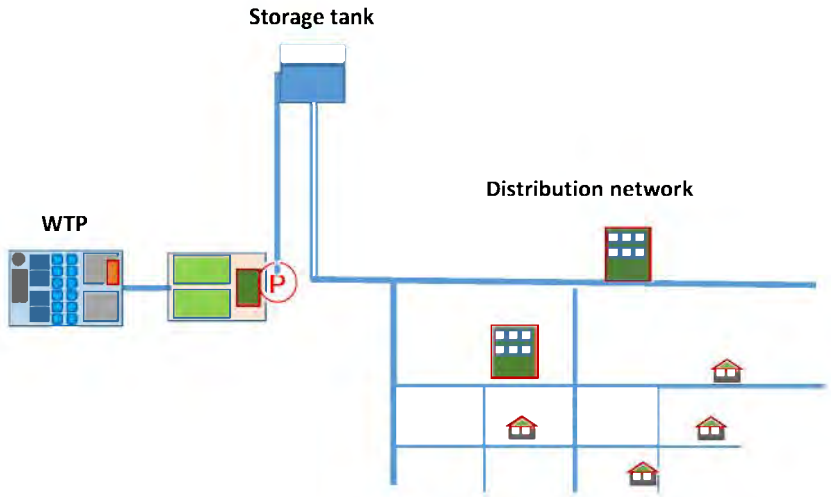
3) Diretamente husi Bomba Bee ba iha Sistema Distribuisaun

Bomba bee nian sei diretamente husi Bee Matan(Source) ba sistema distrubui hafoin ba Konsumedores sira.

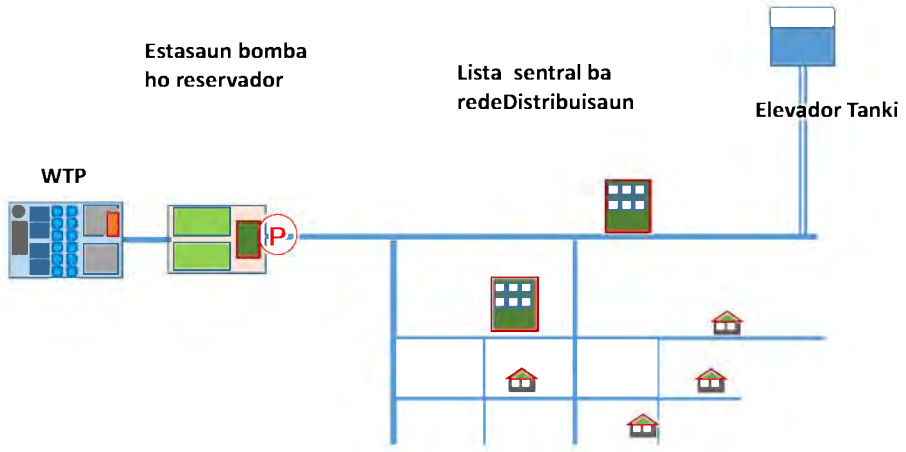
(1) Distribuisaun ho gravitividade



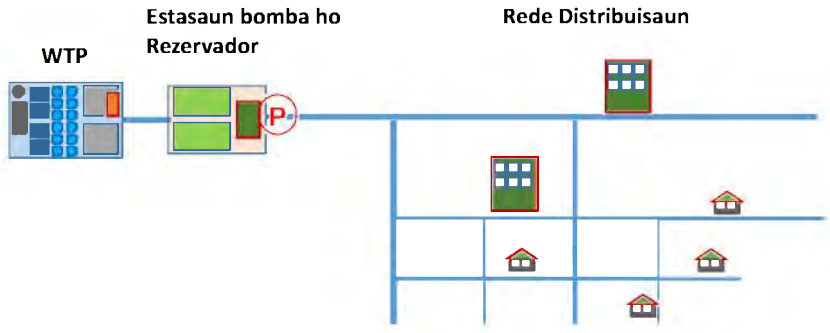
(2)Distribuisaun husi Bomba bee ho tanki Rezerva



(2)Elevador tanki baDistribuisaun bee

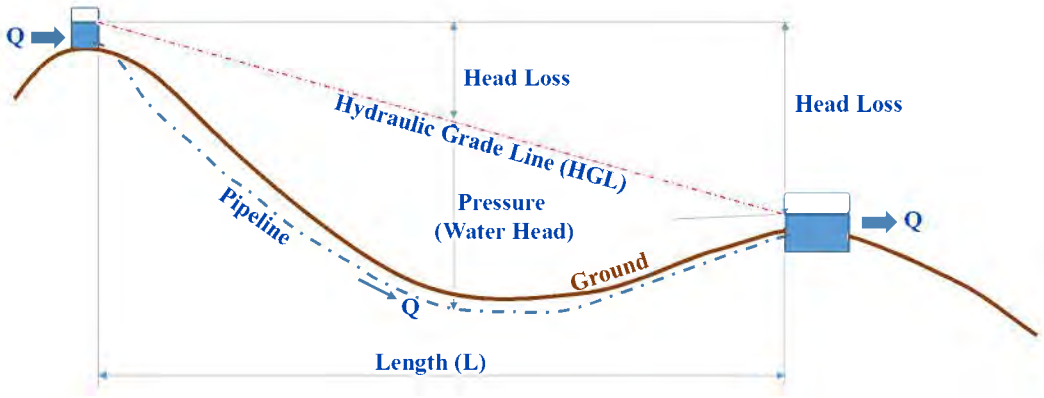


(3 Distrbuisaun husi Bomba



2. Instelasaun pipa HYDRAULICA

(1) presaun (= bee matan la'tama/kehilangan arah)
(2) Bee matan latama (kehilangan arah)
(3) Fatuk musan Hydraulic (HGL)



Formula Hazen–Williams

- Darcy-Weisbach formula
- **Hazen-Williams formula**
- Mannings formula
- Combined Darcy-Weisback and Colebrook-White equation.

$$Q = 0.25783C \cdot (D/1000)^{2.63} \cdot (h/L)^{0.54} \cdot 1000$$

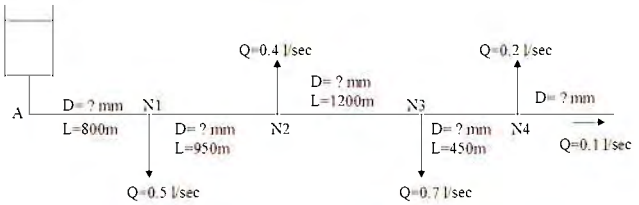
$$D = 1.6258C^{-0.38} \cdot (Q/1000)^{0.38} \cdot (h/L)^{-0.205} \cdot 1000$$

$$h = 10.666C^{-1.85} \cdot (D/1000)^{-4.87} \cdot (Q/1000)^{1.85} \cdot L$$

$$C = (Q/1000)/(D/1000)^{2.63}/(h/L)^{0.54}/0.27853$$

h: Bee ulun la'tama/kehilangan arah.
C: bee suli(groseiru) koeficiente
D: Pipa diametru(m)
Q: Media bee suli(m^3/s)
L: Pipa nia klean(m)

Pratiku



Node	GL(m)	Qflow	Qout	h(m)	L(m)	C	D (mm)	R-Head
A	45		-	-	-	-	-	20.00
N1	30		0.5		800	120		
N2	25		0.4		950	120		
N3	20		0.7		1200	120		
N4	20		0.2		450	120		

3. Kriteria Dizeńu instelsaun pipa

1. **Minimu preasaun ho remota kontrol husi sistema ikus = 3 m**
2. **Maximu violasidade husi bee sulin mai iha Pipa**
   a. Liña Transmisaun = 3.0 m/s
   b. Liña Transmisaun = 1.5 m/s

3. **Minimu violasidade husi bee sulin mai iha pipa = 0.40 m/s**

4. **Faktores Ezezensia bee : hetan Variasaun husi 0.3 (minimu Ezezensia /water demand) to,o 3.0 (Ezezensia nian/Water demand nia as)**

5. **Permite ba head loss(Kehilangan arah): minimum(permite despeza nebe as minimum) = 0.50 m/1,000 m, maximu = 10 m/1,000 m**

6. **Premite ba preasaun: minimum(permite ba preasaun minimum) = 3 m, maximum = 70 m**

4. Selesaun materias ba instelasaun pipa

Parameters	GI	PVC	PE
Crushing strength versus superimposed loads in trench	Excellent	Fair	Poor
Burst strength versus internal pressure	Excellent	Good	Good
Durability	Fair	Excellent	Excellent
Resistance to corrosion	Poor	Excellent	Excellent
Flow capacity	Fair	Excellent	Excellent
Resistance to external mechanical injury	Excellent	Fair	Fair
Ease of installation	Easy	Must be handled gently. Must be buried	
Pipe Cost	High	Low	Low
Cost per fitting	Low	High	High
Number of fittings	High	High	High

NWRC RWS Volume I, Design Manual

Comparison of Pipe materials (Komparasau husi Materia pipa)

Material Property (Propiadadi Material)	DI	PVC	HDPE
Tensile strength (tensia hodi sukat)	60,000 psi	7,000 psi	3,200 psi
Corrosion resistance (Rezistensia ba Feruziu)	Good (diak)– w/cement lining (lapisan cement)	Diak liu	Diak liu
UV resistance (Rezistensia UV)	Diak liu	Gradual strength decline	Los - w/carbon black (karbon Metan)
Diameter range (Distansia entre diametru)	3" - 64"	4" - 12" (C900) 14" - 48" (C905)	4" - 63"
Type of joints (Tipu nebe hamutuk)	Push-on or mechanical (Dudu tama ka mekanikamente)	Push-on or mechanical (Dudu tama ka mekanikamente)	Heat fused (Kombinasaun ho manas)
Need for special bedding for typical installations(Persiza tipu instalasuan)	Lae	Los	Lae
Anticipated service life (antisipada ba kargo servisu)	Ba tinan 100	Ba tinan50 - 100	Ti nan50

EPA 816-D-09-001 November 2009

5.Asesoris Transmisaun ho Distribuisaun Prinsipal

(1) Valvula

a. **Isolation Valves(Izulasaun valvula)**

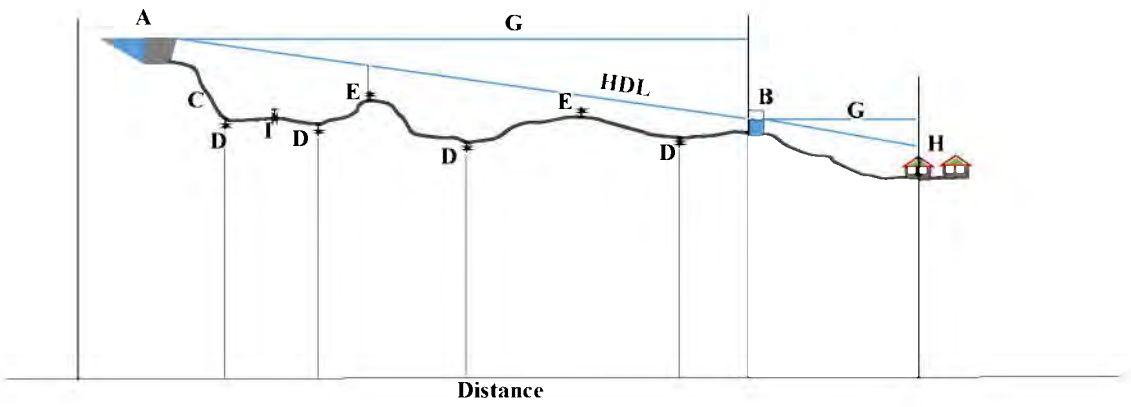
b. **Directional Valves (Dirasaun Valvula)**

c. **Altitude Valves (Elevasaun valvula)**

d. **Air Release Valves and Vacuum Breaking Valves**

(valvula hasai anin ho valvulasatan anin)

e. **Pressure Reducing Valves (Preasaun hodi redus Valvula)**



A = Intake structure
B = Storage reservoir
C = Pipeline
D = Blow-off valve
E = Air valve

HDL = Hydraulic grade line
G = Static head
H = Rural town or Village
I = Sectioning valve (every 1.5 km)

(2) Parti ligasaun

a.Ligasaun ba tipu nebe hanesan ho medida pipa

OnionUnidade ida
Coupling(Junta)
Reducers(Redusaun)

b.Ligasaun ba Pipa rua ho medida lahanesan

c. To change the direction of flow (Troka dirasaun husi sasulin)

Elbow (pipa/kurva)
Tee (pipa /T)
Cross (pipa/atravesa)

d. Atu hapara nia sasulin)

Caps, plugs and blind flanges
(Kran Ulun,Taka, loke,/pipa)

6. Tanki rezervador

Kapasitas

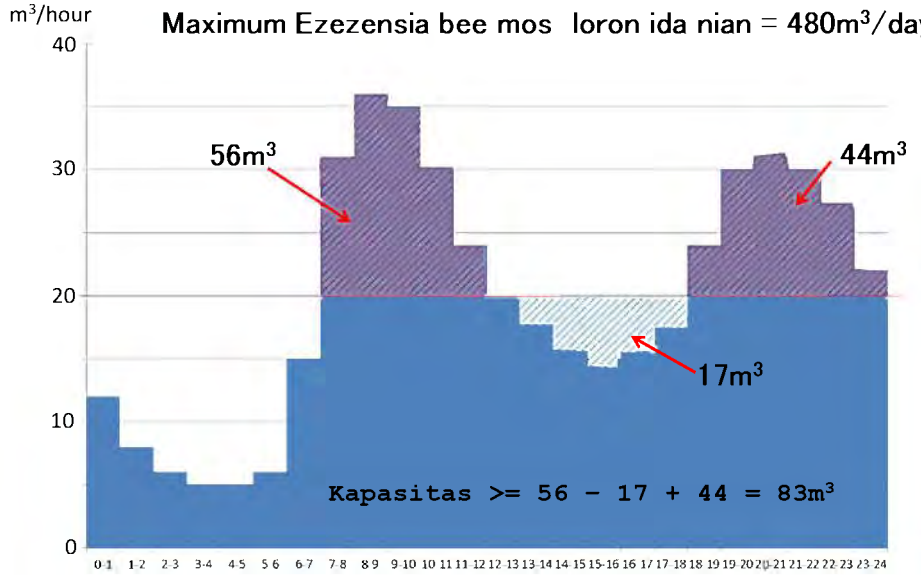
(1) Cr = (1/4) (ADD)

Iha nebe :
Cr = Reservoir ho kapasitas iha ninia litru
ADD = Medio ba Ezezesia loron ida kada litru

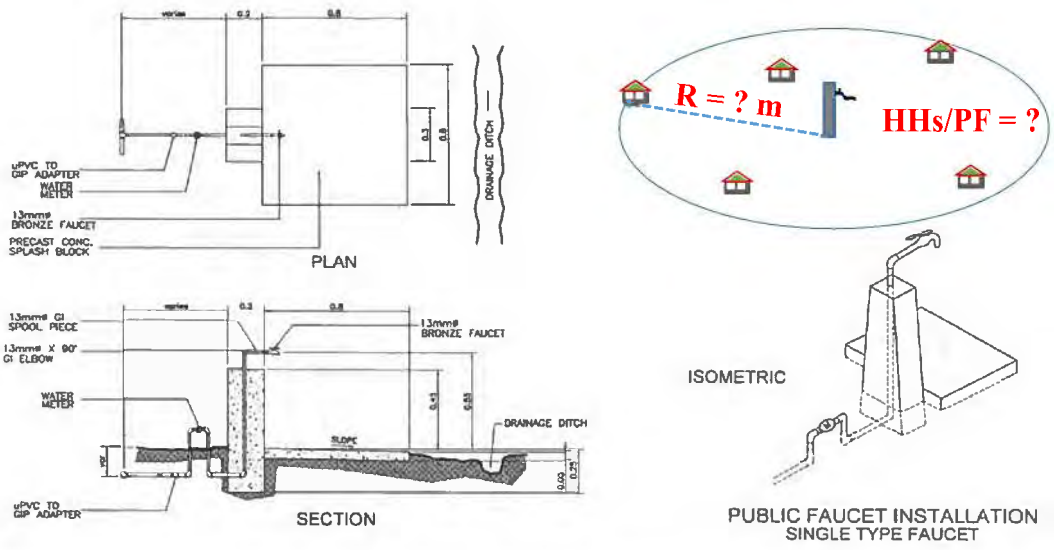
(2) Kalkulasaun husi oras ba iha MDD

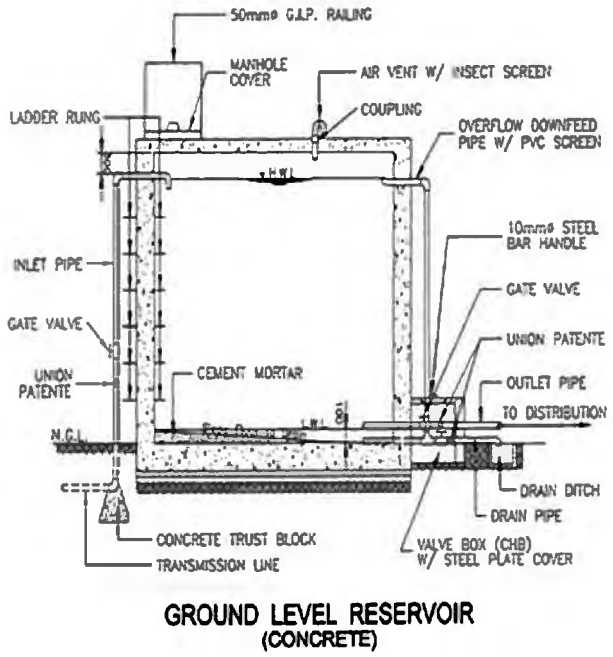
Iha nebe :
MDD = Maximum Ezezensia lororn ida nian

Kalkulasaun kapasitas husi Rezervador



6. Torneira publiku ka Instalasaun





GROUND LEVEL RESERVOIR
(CONCRETE)

(1)Pipa bee dalan hodi tama
Torneira odan matan

(2)Pipa bee dalan hudi sai
Torneira odan matan nian

(3)Bee resin suli sai husi pipa
Ligasaun pipa ba valeta

(4)Pipa baleta nian
Valvula ulun, ba baleta(parit,got)

(5)Anin Ventelasaun
Sekrin ba insetus

(6) Tampaun matan

(7)Indikador ba volume bee

Service Level/ Pelayanan

Konsumi bee Per kapita = ?

Tornera Publiku ka Uma kain ?

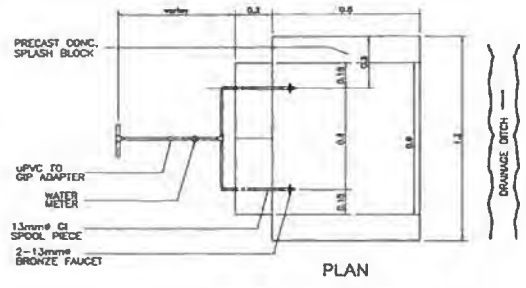
- Multi-tap in house

100 l/c/d

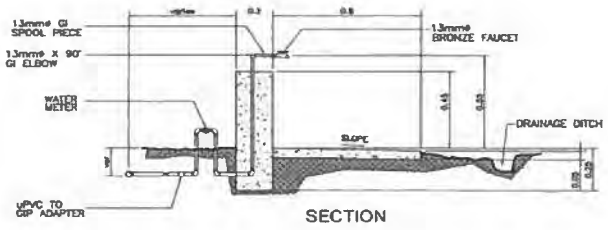
→ 50m (2.5min)
50 l/c/d

→ 50m – 500m (2.5min - 15min)
20 l/c/d

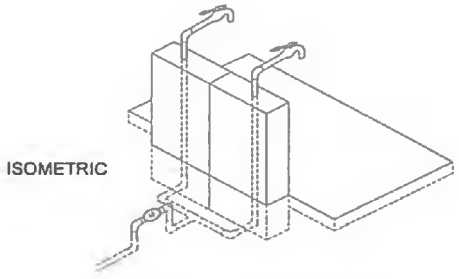
→ 500m (15min)
Below 5 l/c/d



PLAN



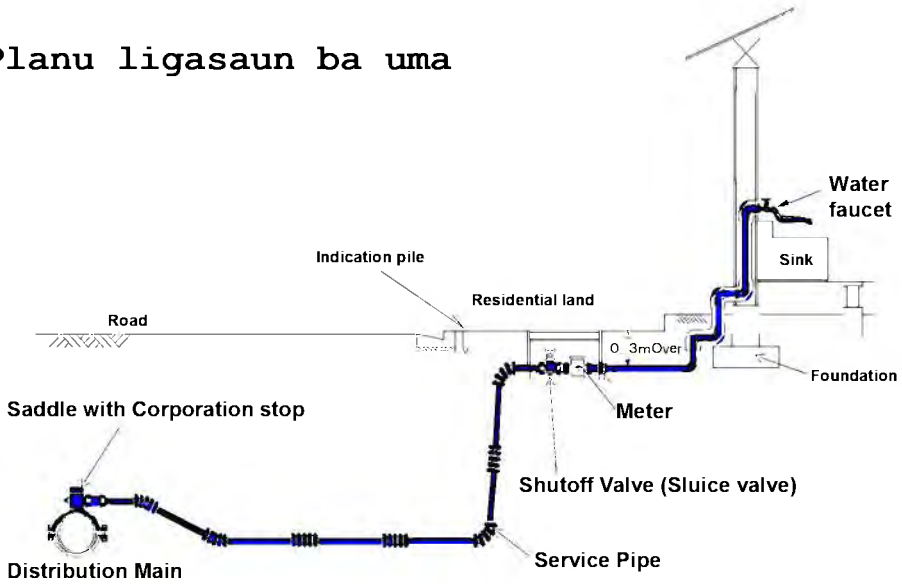
SECTION



ISOMETRIC

PUBLIC FAUCET INSTALLATION
DOUBLE TYPE FAUCET

Planu ligasaun ba uma

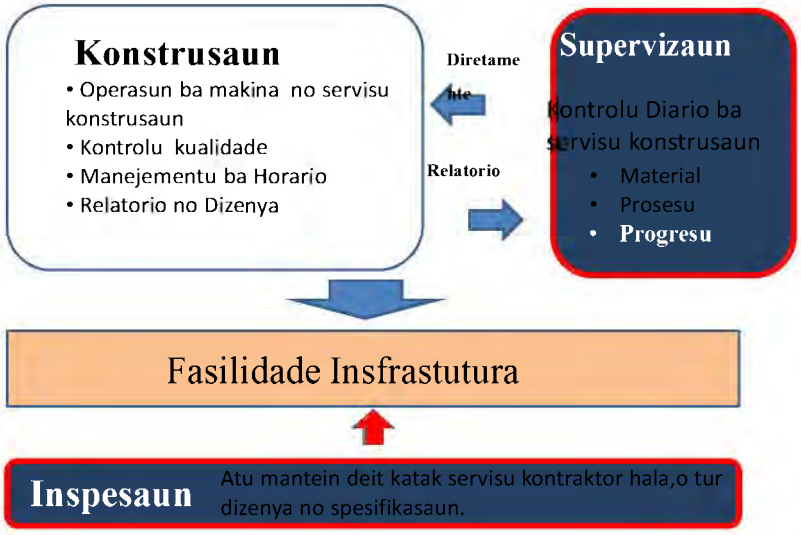


PART II
Projetu Inspeksi Bee Mos iha Rural

Lisaun 6 Inspesaun Konstrusaun

- Saida mak inspesaun konstrusaun ?
- Prosedementu Inspesaun
- Pontu Inspesaun

1. Saida mak Inspesaun Konstrusaun ?



Los ka ,Lae,sira ne,e hotu ka La iha liu

Diskusi

Sa deit mak persiza hodi avalia kualidade infrastutura nebe diak?

Kapasidade kontraktor nian ba konstrusaun

ka

Supervizaun

ka

Inspesaun

Inspesaun katak

Atu haforsa katak kontraktor nia servisu tenke tuir dokumentu kontratu no spesifikasaun projetu.

Halo Informa ba kontraktor
Kontraktor nia servisu tenke akseptable
Pagamentu postphoned.

Projetu na,in simu fasilidade no montate pagamentu kontratu.

Operasaun

Dokumentu Kontratu (dizenyu)

lokasaun, aspetu fizika, dimensiu de servisu, layout, profile, cross-sections, no detalya seluk.

Spesifikasaun

hetan tertulis arah teknis no amandamentu servisu nian no fo instrusaun nebe la indika lolos iha dizenya nia laran.

Inspesaun Konstrusaun/ Deskrisaunservisu

Geralmente inspesaun personalidade tenke justu tuir item nebe tuir mai ne'e:

a. Spesifikasaun ba material no pratika servisu nian tenke ho justu.
b. Provas ba kuantidade kontrolu ba iha material tuir konkordansia level sevisu.
c. Servisu hotu-hotu tuir etapa ,dimensi de servisu no hanesan hatudu iha spesifikasun dezenyu ba servisu kostrusaun.

2. Prosedemento Inspesaun

Pre-Inspesaun

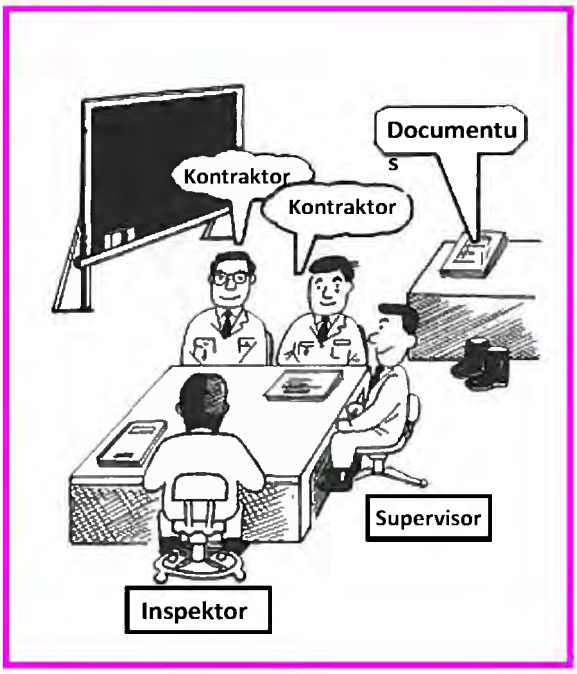
1. Atu simu planu sira hotu, aprova dizenya, spesifikasaun, no dokumentu sira seluk relasaun ho projetu nebe refere.

Hahu Inspesaun

2. Esplikasaun kona ba outline husi konstrusaun sira hotu noinspesaun sira nebe uza dizenyu no BOQ husi kontraktor.

Inspesaun

3. Hahu inspesaun iha site ka inspesaun dokummentus.



Komesa hahu inspesaun

a. Esplikasaun ba servisu konstrusaun husi kontraktor
   - Dizenyu
   - BOQ
   - Teknika spesifikatsaun

b. Esplikasaun ba iha Inspesaun ho
   - Dizenyu
   - BOQ

Site Inspesaun

Documentu Inspesaun

2-1. Inspesaun iha Site

Inspesaun Intermediata no inspesaun kompleta

(1) Dimensio medida nian ba iha fasilidade, no kontrola nia sasukat no relata hatuir dizenya
(2) Kontrola material kona ba montante ba iha kualidade.
- On-site/iha terenu halo prova b aiha material
- komtiudo ba iha montate iha terenu
- Garantia kualidade Dokument no provas
- Entrega Dokumentus

(3) Hare no kontrola external nebe mosue husi
- Trabalhador
- Situasaun iha konstrusaun nia laran

2-2. Documentu Inspesaun

(1) Konfirmasaun ba Dokumentus nebe hatama
1) Documentus kontratu: valor kontratu ho kondisaun pagamentu.
2) Bill of Quantities (BOQ) relata/hatudu presu unidade ho kuantide
3) Diskripsaun kona ba mudansa, alterasaun ka variasaun, karik iha
4) Relatorio inspesaun Terenu husi KDD
5) Data Digital husi BOQ

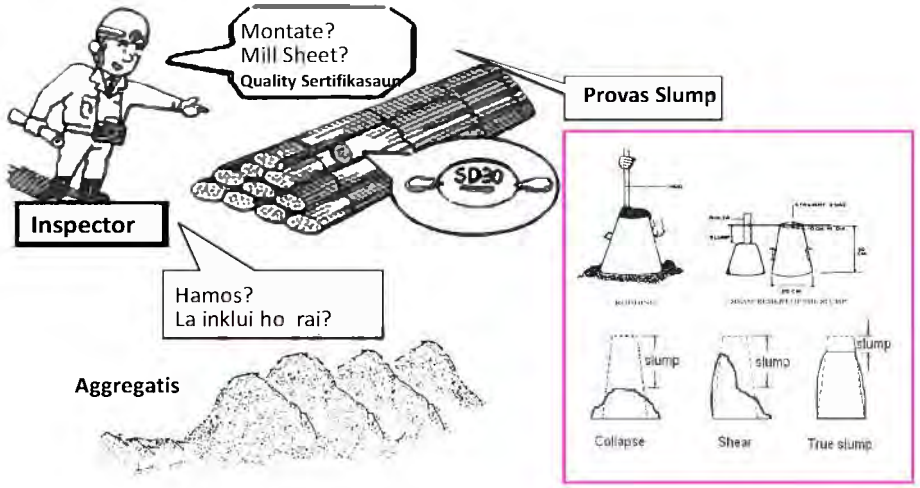
(2) Konfirmasaun ba kondisaun pagamentu
(3) Kalkulasaun iha volha Lisitasaun
(4) Konfirmasaun ba kompleta de servisu iha BOQ, dizenya no fotos
(5) Konfirmasaun ba horario servisu
(6) Konfirmasaun ba rezultadu inspesaun husi KDD

3. Pontu kontrola

1. **Kontrola ba Material**
2. **Kontrolu ba prosesu**
3. **Sasukat dimensio ba iha fasilidade**
4. **Kontrola externalidade nebe mosu**
5. **Kontrola ba iha BOQ**
6. **Kontrola konstrusaun Dizenya/ fotografia**
7. **Ezemplu husi check points**

3-1. Kontrola material

Kontrola material konaba montate no kualidade.



GUIDELINES BA PRODUSAUNKONKRETU NEBE DIAK

1. Uza material nebe los
   - -Semente Portland
   - - Aggregate (Fatuk musan & raihenek)
   - - Bee
   - - Mistura
2. Atu obtain Proporsaun Mistura nebe diak
3. Metodu kontrola Proporsio no mistura
   - - Mistura ba homogen
   - - Uniforma batches
4. Hatur/hafatin
5. Curativu/hospitalizasaun
   - -Atu prenvene konkretu nia lalaok husi sasulin nebe lais

INSPESAUN KONKRETE

Atu inspekta persiza refere tuir dezenya no spesifikaaun, atu kalkula ba buat nebe kopleta no rai record sira ne'e tuir mai ne'e :

1.Kualidade no proposaun husi material konkreta nian hodi halo konkreta nebe forte/forsa;

2. Hadia Konstrusaun no hasai forma konstrusaun nian nebe ladiak;

3. Hatur no hadia reinforcement;

4. Mistura ,hodi haforsa conkretu;

5. Linya ligasaun ba iha didi konkretu nian

6. Geral Progresu nian kona ba servisu.

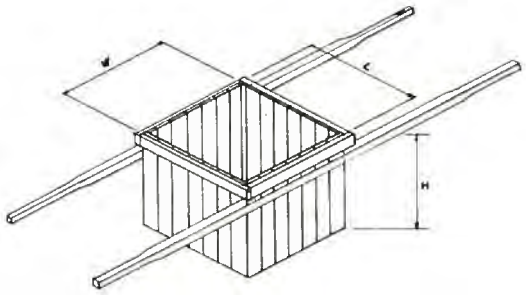
Hetan abut Aggregates ka Raihenek - Hasai ou haketak rai no tahut -

Rai no tahu mosu maka,as liu bele detekta husi prova mak tuir mai ne,e :

1. **Ense bee iha botir (1.14ru lit)erlenmeyer iha rai henek to'o nia klean 5.0cm(2 ince);**
2. **Aumenta bee iha botir ka termos to'o ¾ no halo nakonu;**
3. **Doko botir ne'e durante menutu ida ho ninia getaran to'o pontu nebe didika;**
4. **Mantein hela stik no pozis aun hari to'o menutu 30;**
5. **Observe ba iha raihenek ne'e karik liu husi 3,2mm ba ninia lapisan sedimental nian, hodi hetan raihenek ia sempel laran katak ne,e labele uza iha servisu konstrusaun nian, maibe Agregat hirak ne,e bele uza wainhira fase halo momos husi fo,er hirak nebe lao tuir iha rai henek laran.**

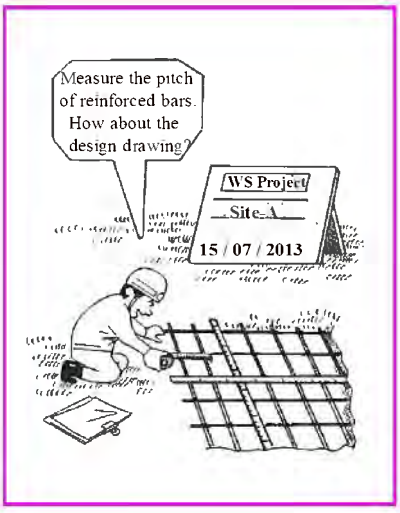
Tipu mistura konkretu nebe uza

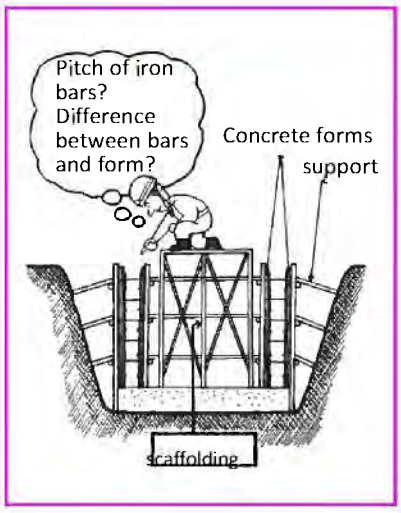
Class	Typical Concrete Mixes (volume proportions)				Quantity of Materials per m^3 of Concrete				Usage
	Cement	Water	Sand	Gravel	Cement		Sand	Gravel	
					bags	m^3	m^3	m^3	
AA	1	0.7 – 1.0	1.5	3.0	10.4	0.294	0.44	0.88	Foundation
A	1	0.7 – 1.0	2.0	4.0	7.9	0.223	0.45	0.9	Beams & Slabs
B	1	0.7 – 1.0	2.5	5.0	6.5	0.184	0.46	0.92	Columns
C	1	0.7 – 1.0	3.0	6.0	5.5	0.156	0.47	0.94	Flooring on fill, and pavements
D	1	0.7 – 1.0	3.5	7.0	4.8	0.136	0.48	0.96	Big Mass Footings



Capacity (m^3)	Inside Measurements		
	Length (m)	Width (m)	Height (m)
0.10	0.4	0.4	0.63
0.20	0.6	0.6	0.56
0.30	0.8	0.8	0.47

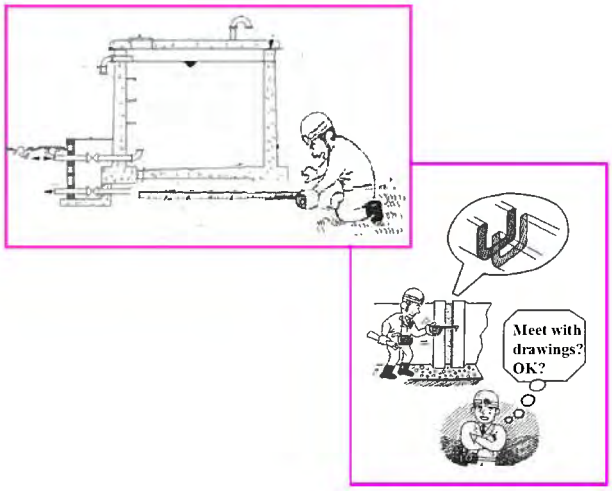
3-2. Kontola prosesu





3-3. Sasukat ba fasilidade Dimensi

Atu hetan medida ba dimensi fasilidade nian, no tenke kontrolu ho medida hodi katak tuir lala'ok ne'e tuir diezenya ou lae.



3-4. kontrolu ba external nebe mosu

Cold Joints/sendimentasaun didin

Nobuaki Otsuki, Junji Yokokura dan Takahiro Nishida
Tingkat Teknologi Realisasi Beton di Negara Berkembang
- Masalah Beton di Dunia

Ezemplu nebe ladiak

Bubble nebe lafaboravel)

Minus husi Konstrusaun/Lackof corner

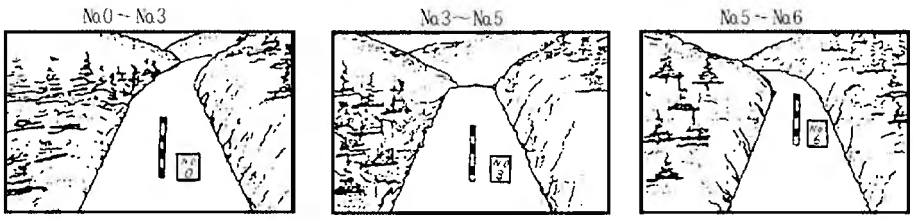
3-5. Kontrolu ba BOQ

Item	Shape/ Spec.	unit	Quantity			Remarks
			Contract	Execution	Execution Rate (%)	
Pipe Laying	D 50 mm	m	1,500	1,350		
Concrete Tank	2 x3 x2.5		1	1		RC
Excavation	0.4 x 0.3	m3	180	162		0.12m3/m

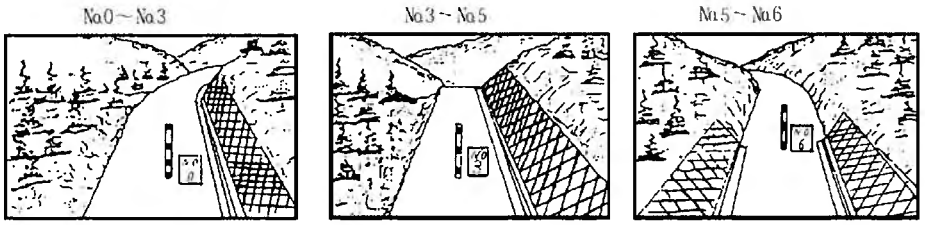
3-6. Kontrolu ba fotografia konstrusaun nian

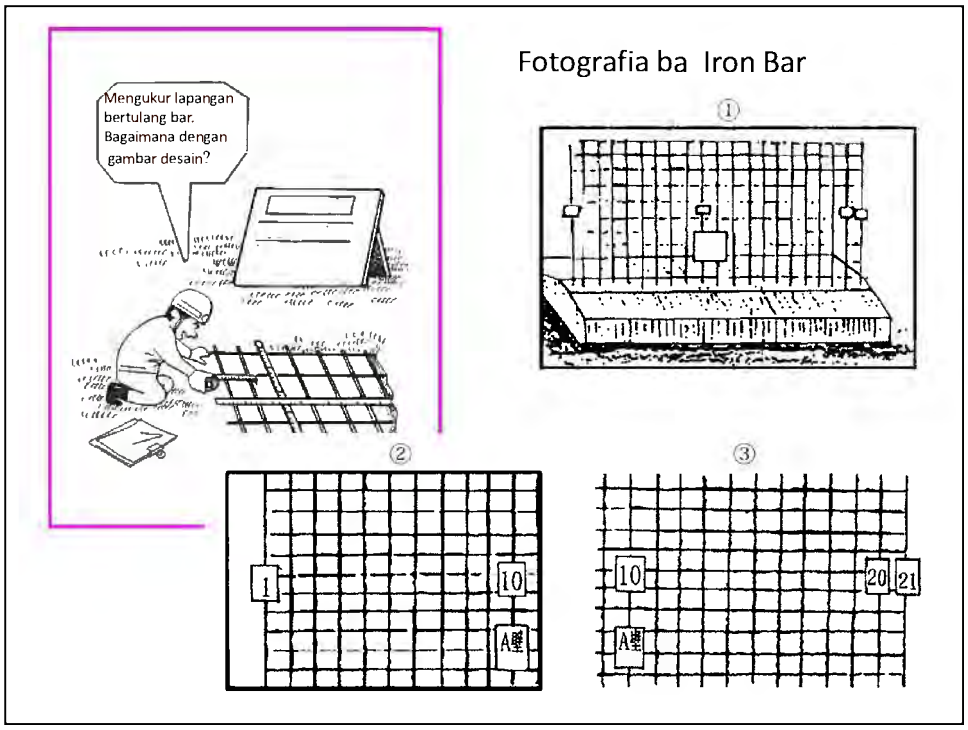
1. Fotografia ba konstrusaun no maneira rezolve
2. Fotografia kona ba prosesu konstrusaun (metodu edifisiu)
3. Fotigrafia ba uza material
4. Fotografia ba kualidade materia
5. Fotografoia ba fasilidade dimensi Fotografia nian

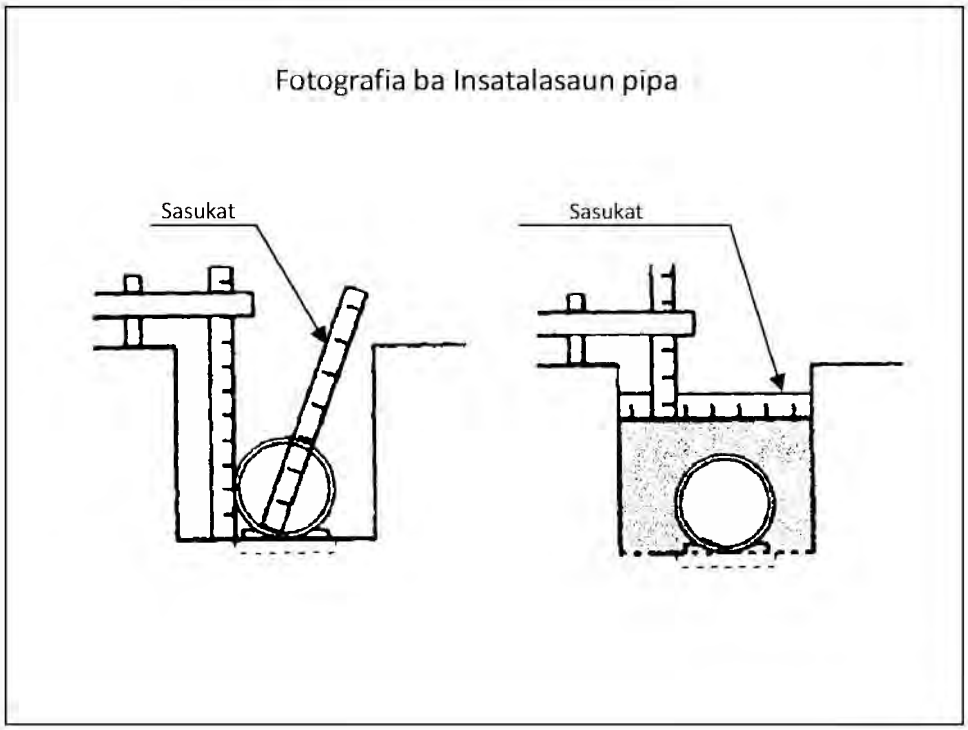
Pre-Konstrusaun



Post/paska-Kontrusaun



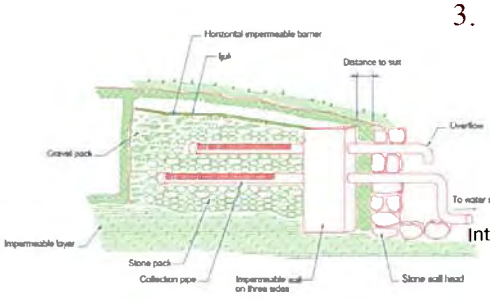

Mengukur lapangan bertulang bar. Bagaimana dengan gambar desain?
Fotografia ba Iron Bar
①
②
③
1
10
A壁
10
20
21
A壁

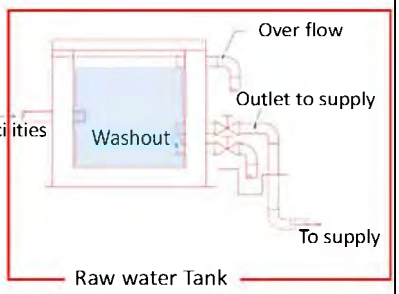

Fotografia ba Insatalasaun pipa
Sasukat
Sasukat

3-7. Ezemplu ba pontu kontrolu

Bee Matan no Fasilidade Intake

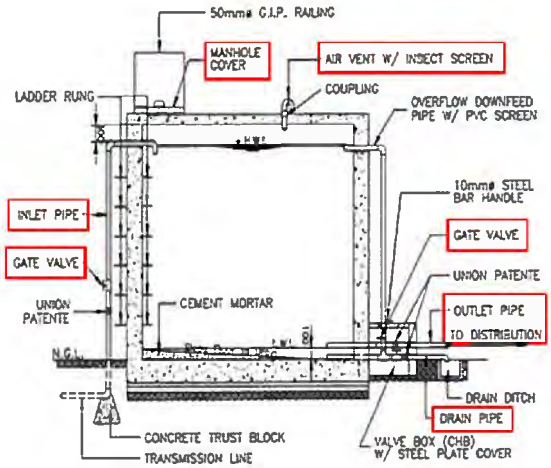
1. Kualidade husi bee Matan
2. Kualidade husi bee nia Hun
3. Montate husi fornesesmentu Bee





Persiza halo tanki be nian tuir Ezemplu ida ne'e.

Reinforced konkrete Reservoir



GROUND LEVEL RESERVOIR
(CONCRETE)

(1) Inlet Pipe & Valve

(2) Outlet Pipe & Valve

(3) Overflow Pipe

(4) Drain Pipe & Valve

(5) Air Vent

(6) Manhole

(7) Water Level Indicator

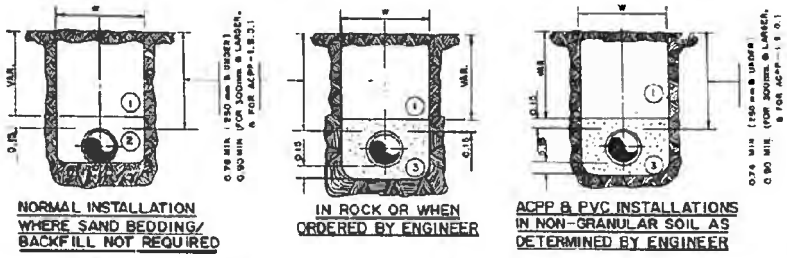
Laiha valvu iha pipa inlet .

Laiha valvu iha pipa outlet.

Pontu Inspesaun ba Pipeline

1. Material
2. Diametru Luan no naruk
3. Exkavasaun/ke'e raikuak no Pipe Laying
4. Profile Pipeline
5. Appuramentu ba Pipeline
6. Hametin kaisa bloku nian no ankor

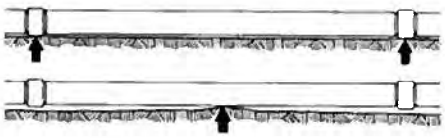
Exkavasaun no Pipe Laying



① Compacted selected native material backfill.
② Compacted selected native material in 0.15 m layers.
③ Approved sand bedding & backfill hand placed & compacted.

Los

La Los

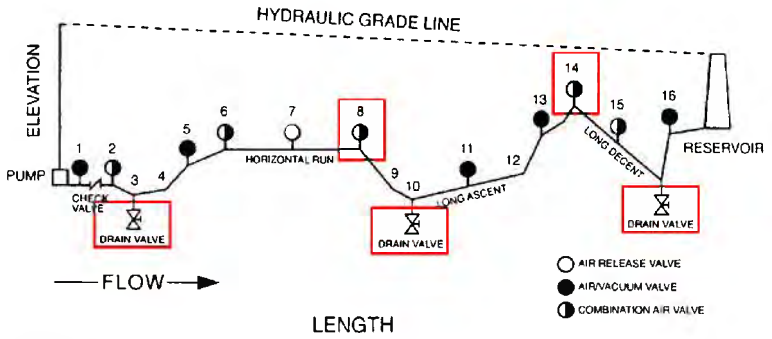


La justu ba junta Pipa nian no kleuk

Atu halo pontu nebe los iha central nian, halo tuir brance nebe iha.

Tenke uza bend joint (22½).

Ezemplu ba profile Pipeline Illustrasaun, no fatin Valvvula nian



NO.	DESCRIPTION	RECOMMENDED TYPES
1	Pump Discharge	Air/Vacuum for Pumps
2	Incr. Downslope	Combination
3	Low Point	No Valve Required
4	Increase Upslope	No Valve Required
5	Decrease Upslope	Air/Vac or Combination
6	Beginning Horizontal	Combination
7	Horizontal	Air/Rel or Combination
8	End Horizontal	Combination

NO.	DESCRIPTION	RECOMMENDED TYPES
9	Decrease Downslope	No Valve Required
10	Low Point	No Valve Required
11	Long Ascent	Air/Vac or Combination
12	Increase Upslope	No Valve Required
13	Decrease Upslope	Air/Vac or Combination
14	High Point	Combination
15	Long Descent	Air Release or Combination
16	Decrease Upslope	Air/Vac or Combination

Lokasaun Valvula Anin iha pipa nia naruk

Valvula anin instala iha linya pipa nian atu eskuta anin no prevene ba iha vacuum nia kondisaun no hodi haforsa. Ba AWWA Steel Pipe nia manual hodi halo rekommenda,Valvula Anin nia tenke tuir pontu linya pipa nian.

1. **As pontu nian: K**ombinasaun ho Valvula Anin
2. **Naruk Horizontal nian hodi Halai: Hasai Anini ka** Kombinasaun Valvula iha 380 to 760 m ba ninia intervalu.
3. **Hamenus ninia Desentus: K**ombinasaun Valvula iha 380 to 760 m ba ninia intervalu.
4. **Ascents nia naruk: Anin**/Vacuum Valvila iha 380 to 760 m ba ninia intervalau.
5. **Sasulin nia As:** Anin/Vacuum Valvula
6. **Sasulin nia minus: K**ombinasaun ho valvula Anin

From "Theory, Application, and Sizing of Air Valves"
(Val-Matic Valve and Manufacturing Corporation)

Valvula hasai anin/Air Release Valves

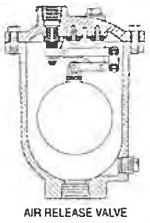
Valvula ida ne'e medida nian iha kuak kiik katak fungsaun ninian hodi hasai anin wainhira korenti bee nian servus pipa nia laran

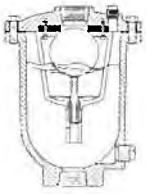
Anin/valvu supa aninAir/Vacuum Valves

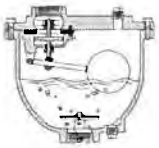
Anin/Vacuum valvula monta tenke iha bee nia hun no iha fatin as no mos iha kuak nia volume boot bomba nia trabalho hodi ensc iha valvula pipa nian I nunc mos hodi prevenc kondisaun vacuum nian atu labele afeita ba bee maran iha pipa laran.

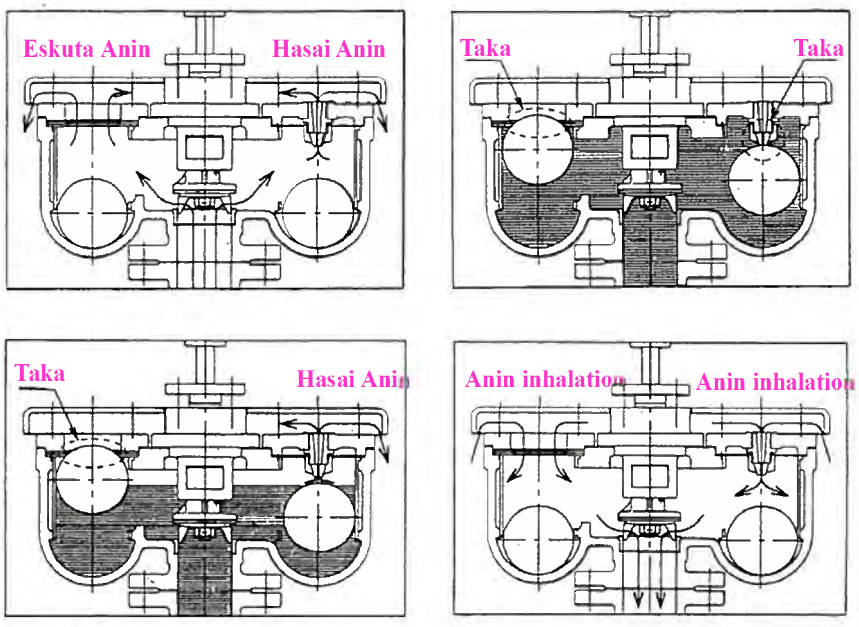
Kombinasaun Valvula anin

Kombinasaun valvula anin, atu hatur fungsaun vacuum hodi hasai anin, hancsan dirasaun nebc forte no diak, ba ihan pontu nebe as,valvula ida ne'e hetan kombinasaun ba iha kuak rua nebe kiik husi anin fatin ka vacuum nebc boot hodi halo junta ida.

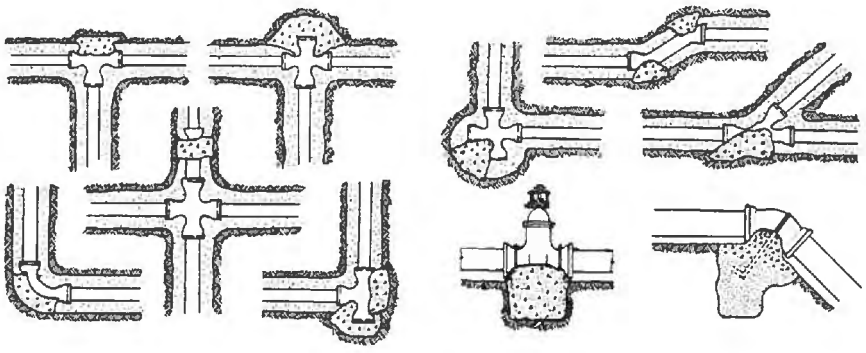

AIR RELEASE VALVE


AIR/VACUUM VALVE


SINGLE BODY COMBINATION



Hametin kaisa & Ankor



THRUST BLOCKS and ANCHORS

添付資料 19 座学研修教材(給水)(インドネシア語版)

Pelajaran 5 Transmisi dan Sistem Distribusi

- Pipa Hidrolik
- Kriteria Desain Pipeline
- Seleksi Bahan pipa
- Perlengkapannya untuk Transmisi dan Distribusi Induk
- Reservoir (Tanki)
- Koneksi Layanan

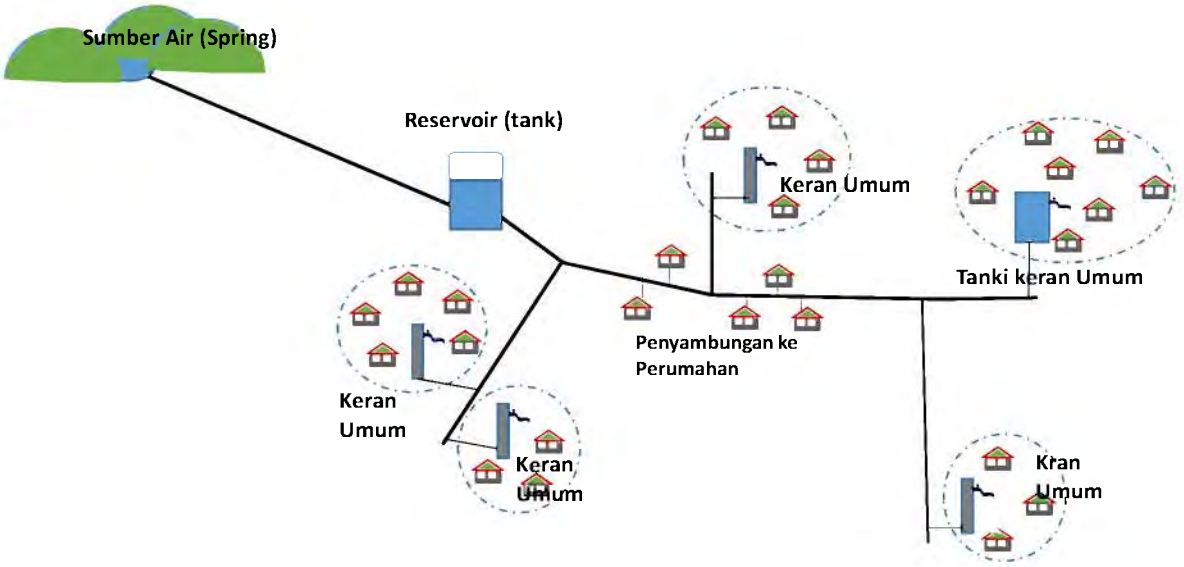
1. Sistem Transmisi & Distribusi

(1).Melalui aliran gravitasi
Ideal set-up ini adalah ketika lokasi sumber air berada pada ketinggian ,jauh lebih tinggi dari area yang akan dilayani.

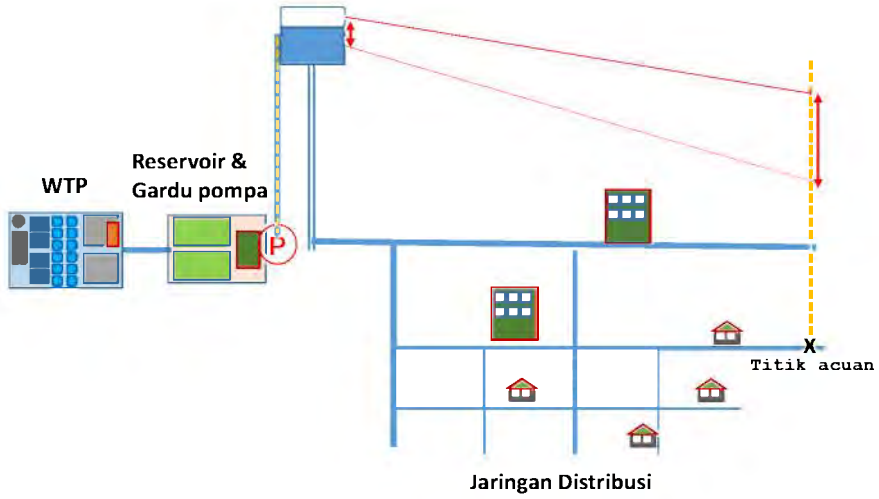
(2) Penyimpanan pompa melalui
Air adalah (a) dipompa ke jaringan pipa distribusi, kemudian ke konsumen, dengan kelebihan air akan ke tangki penyimpanan, atau (b) dipompa ke tangki penyimpanan pertama, kemudian air didistribusikan oleh gravitasi dari tangki ke konsumen.

(3) Dipompa melalui langsung ke sistem distribusi
Air dipompa langsung dari sumbernya ke sistem distribusi kemudian ke konsumen.

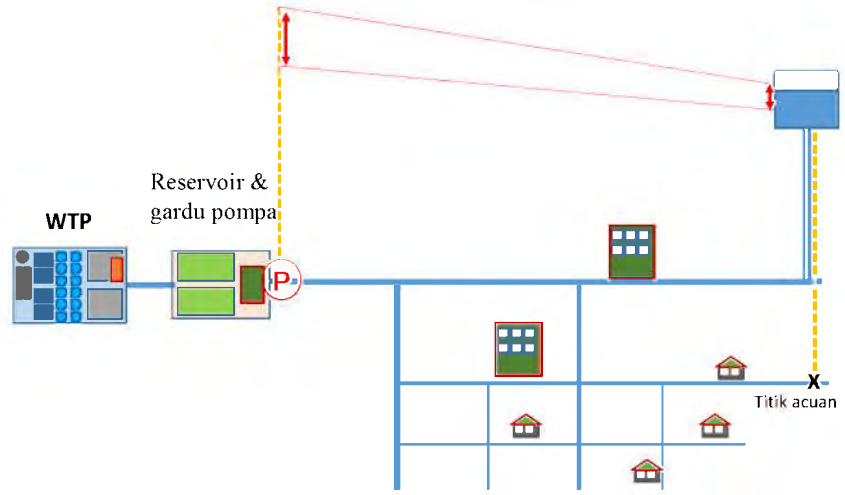
(1) Distribusi oleh gravitasi



Distribusi melalui pompa dengan penyimpanan

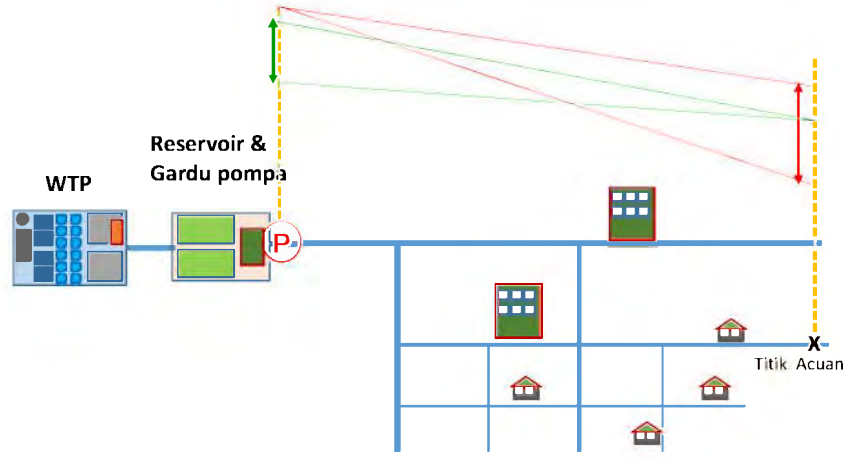


(2) Distribusi melalui pompa dengan penyimpanan



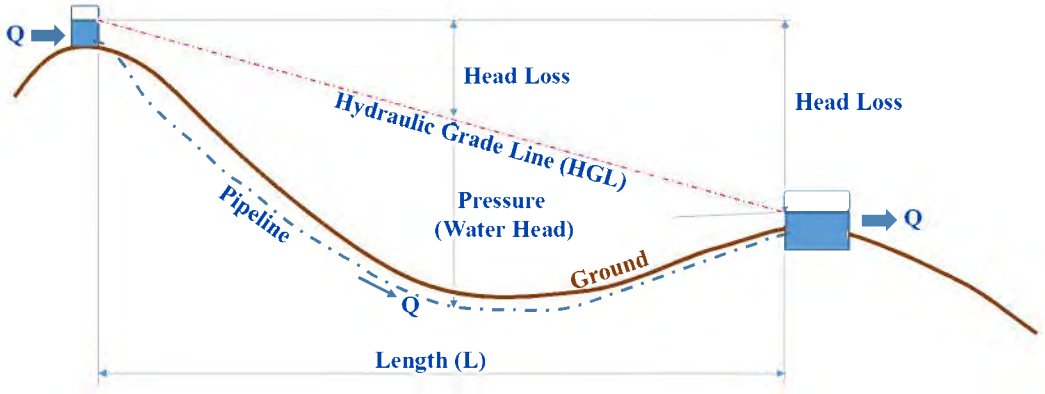
(3) Distribu melalui Pompa

a. Pengontrolan terhadap Discharge head
b. Pengontrolan pada Reference point head



2. PIPELINE HYDRAULICS

(1) Pressure (= Water Head) Tekanan
(2) Head Losses/ kehilangan arah atau kerugian air
(3) Hydraulic Grade Line (HGL) Hidrolik Susunan Baris (HGL)



Rumus Hazen–Williams

- Rumus Darcy-Weisbach
- Rumus **Hazen-Williams**
- Rumus Mannings
- Dikombinasikan Darcy-Weisbach dan persamaan Colebrook-Putih

$$Q = 0.25783C \cdot (D/1000)^{2.63} \cdot (h/L)^{0.54} \cdot 1000$$

$$D = 1.6258C^{-0.38} \cdot (Q/1000)^{0.38} \cdot (h/L)^{-0.205} \cdot 1000$$

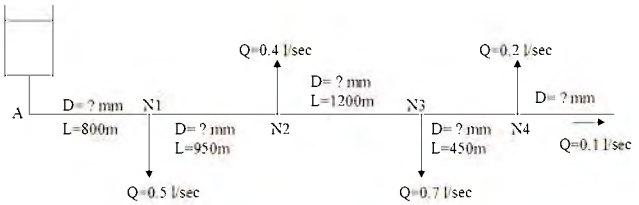
$$h = 10.666C^{-1.85} \cdot (D/1000)^{-4.87} \cdot (Q/1000)^{1.85} \cdot L$$

$$C = (Q/1000)/(D/1000)^{2.63}/(h/L)^{0.54}/0.27853$$

h: Head Loss(m) (Kehilangan Arah)

C: Flow(Roughness) coefficient
(koefisien kekasaran aliran)
D: Pipe diameter(m)/Pipa Diameter
Q: Flow rate(m^3/s)/Lajunya Air
L: Pipe Length(m)/Panjang Pipa

Practice
(PIPE-CAL)



Node	GL(m)	Qflow	Qout	h(m)	L(m)	C	D (mm)	R-Head
A	45		-	-	-	-	-	20.00
N1	30		0.5		800	120		
N2	25		0.4		950	120		
N3	20		0.7		1200	120		
N4	20		0.2		450	120		

Practice
(EPANET)

Practice-1

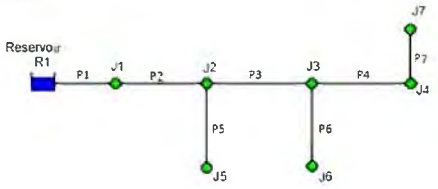


Table 1: Network Node Properties

Node	Elevation (m)	Demand (L/s)
R1	100	0.00
J1	85	0.09
J2	82	0.00
J3	78	0.00
J4	77	0.00
J5	82	0.10
J6	78	0.07
J7	76	0.05

Table 2: Network Pipe Properties

Pipe	Length (m)	Diameter (mm)	C
P1	450	50	120
P2	350	50	120
P3	400	50	120
P4	250	50	120
P5	40	20	120
P6	25	20	120
P7	50	20	120

3. Pipeline Kriteria Desain Manual WB

1 Tekanan minimum pada akhir terjauh dari sistem = 3 m

2. Kecepatan maksimum aliran dalam pipa
- **a. Jalur Transmisinya = 3.0 m/s**
- **b. Jalur Distribusi nya= 1.5 m/s**

3. Kecepatan Minimum aliran dalam pipa= 0.40 m/s

4 Permintaan Factor: bervariasi dari 0,3 (demand minimum) menjadi 3,0 pada (puncak permintaan)

5. Head loss atau kehilangan arah yang diijinkan: minimum = 0.50 m / m 1,000, maksimum = 10 m / 1.000 m

6. Tekanan diijinkan: minimum = 3 m, maksimum = 70 m

Standar DNSA's untuk GFS desain

1 Tekanan statis Max dalam jaringan <= 100 m kecuali kendala topografi
2 Tekanan minimum yang statis dalam jaringan: 5 - 10m

3. Tekanan max-min statis di keran: 5 - 15m

4. Diameter (pipa)
- **a. Antara intake dan tangki sedimentasi> = 50mm**
- **b. Antara tank: Per perhitungan hidrolik**
- **c. Pada keran berdiri: ¾ inci GS**

5. kecepatan
- **a. Diameter pipa 20 - 40mm: 0,3-2 m / detik**
- **b. Diameter pipa 50 - 75mm: 1 - 3 m / detik**

4. Seleksi Bahan pipa

Parameters	GI/Garvonnized iron	PVC/poly vinny chloride	Poly ethylene
Penghancuran kekautan dibandingkan beban ditumpangkan dalam parit	Bermutu	Cukup	Buruk
Meledakn kekuatan dibandingkan tekanan Internal	Bermutu	Baik	Bermutu
Daya Tahan	Bermutu	Bermutu	Bermutu
Ketahan terhadap korisi/kerusakan	Buruk	Bermutu	Bermutu
Kapasitas Aliran	Cukup	Bermutu	Bermutu
Resistensi terhadap cedera mekanik eksternal	Bermutu	Cukup	Cukup
Mudah Instalasi	Mudah	Harus ditangani dengan lembut. Harus dikubur	
Harga Pipa	Tinggi	Rendah	Rendah
Harga per Fitting	Rendah	Tinggi	Tinggi
Jumlah Fitting	Tinggi	Tinggi	Tinggi

NWRC RWS Volume I, Design Manual

Perbandingan bahan Pipa

Bahan Properti	DI	PVC	HDPE
Gaya Tarik	60,000 psi	7,000 psi	3,200 psi
Resistensi karat	Good – w/cement lining	Excellent	Excellent
UV resistensi	Excellent	Gradual strength decline	Yes - w/carbon black
Diameter range	3" - 64"	4" - 12" (C900) 14" - 48" (C905)	4" - 63"
Type of joints	Push-on or mechanical	Push-on or mechanical	Heat fused
Need for special bedding for typical installations	No	Yes	No
Anticipated service life	100 years	50 - 100 years	50 years

EPA 816-D-09-001 November 2009

5. Appurtenances for Transmission and Distribution Mains

(1) Ketup

a.Katup isolasi

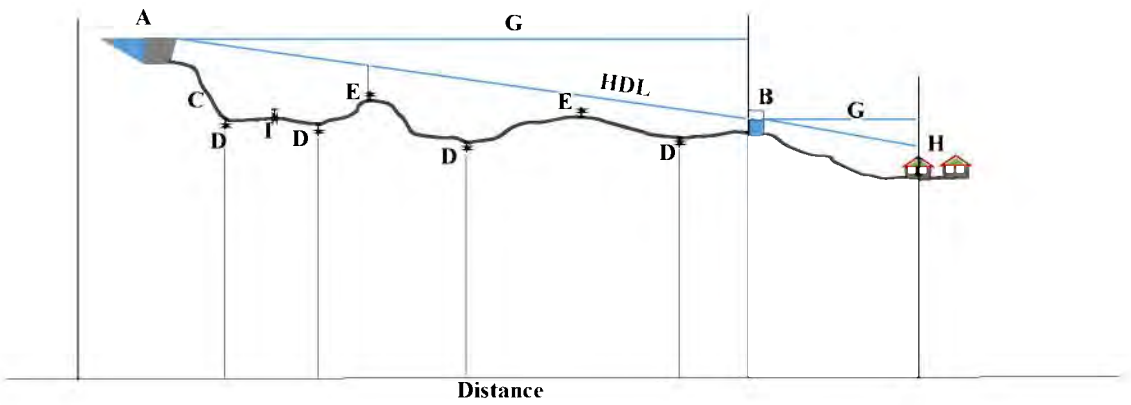
b. Katup directional

c. Katup ketinggian

d. Katup pelepasan Udarah dan Vacuum Katup Melanggar

e. Mengurangi Valves Tekanan

katup relief Air: Sebuah katup udara Ditempatkan di puncak pipa (1) untuk melepaskan udara dan Mencegah udara otomatis mengikat dan tekanan penumpukan atau (2) untuk memungkinkan udara untuk memasukkan baris jika tekanan internal Menjadi kurang kemudian juga dari atmosfer .
= katup Pelepasan Udara



A = Intake structure
B = Storage reservoir
C = Pipeline
D = Blow-off valve
E = Air valve

HDL = Hydraulic grade line
G = Static head
H = Rural town or Village
I = Sectioning valve (every 1.5 km)

(2) Perlengkapan

a. Untuk menghubungkan jenis yang sama dan ukuran pipa:

Serikat
Kopel

b. Untuk menghubungkan dua pipa dengan ukuran yang berbeda:

Reduksi

c. Untuk mengubah arah aliran:

siku
tee
menyeberang

d. Untuk menghentikan aliran:

Caps, busi dan buta flensa

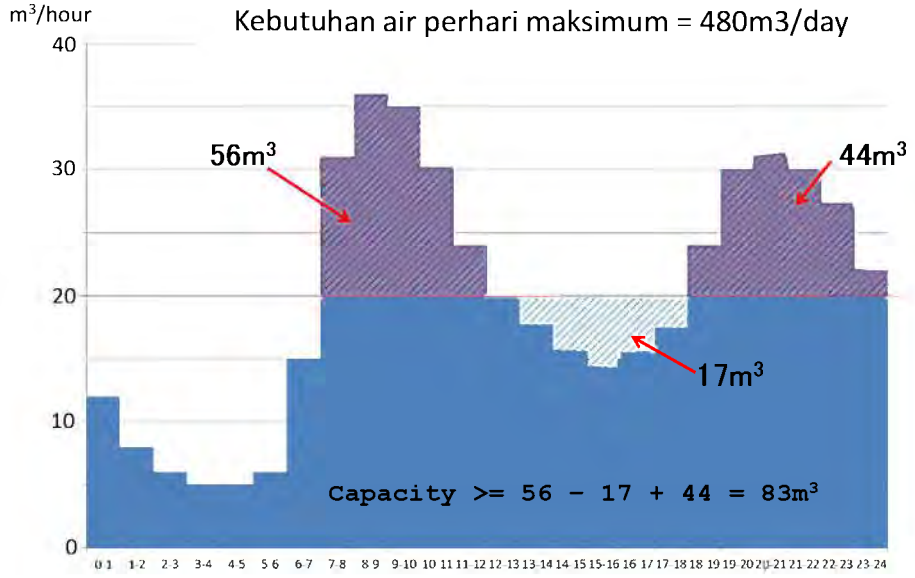
6. Reservoir (Tank)

Capacity

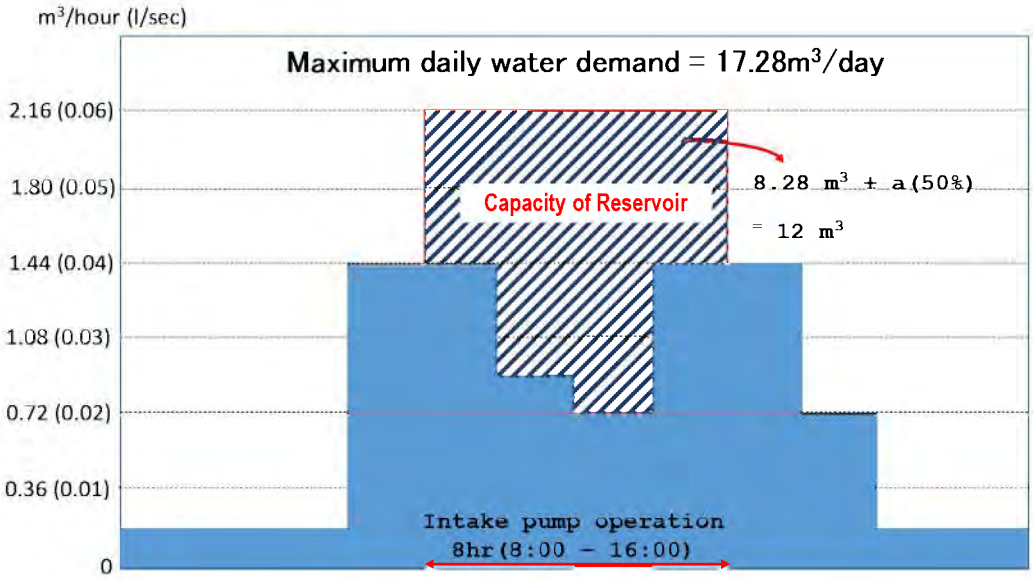
(1) Cr = (1/4) (ADD)
di mana:
Cr = Kapasitas Reservoir dalam liter
ADD = Rata-rata permintaan harian dalam liter per hari

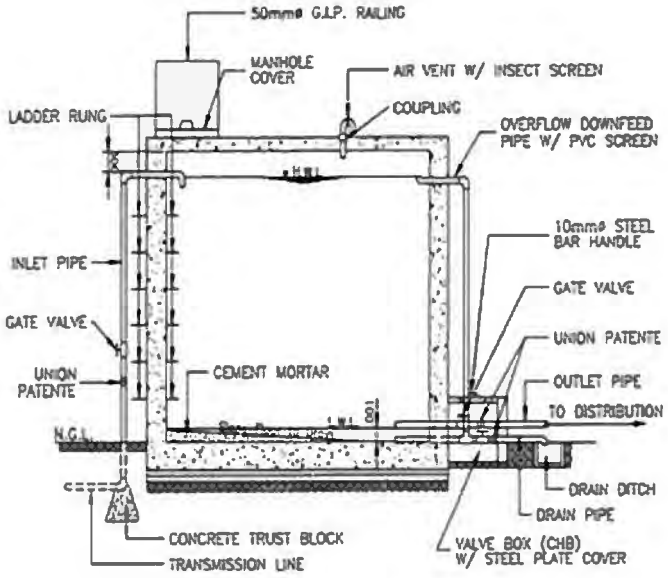
(2) Untuk menghitung dari permintaan per jam MDD
di mana:
PDK = permintaan hari Maksimum

Perhitungan Kapasitas pada Reservoir



Calculation of Reservoir's Capacity





GROUND LEVEL RESERVOIR
(CONCRETE)

(1)Inlet Pipe
Gate Valve

(2)Outlet Pipe
Gate Valve

(3)Overflow Pipe
Connect to drain pipe

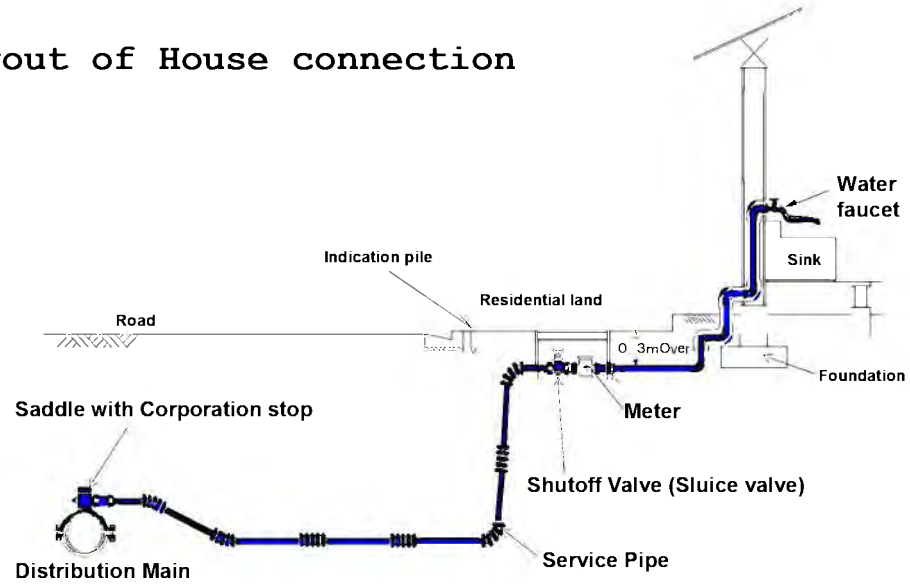
(4)Drain Pipe
Gate Valve, Drain Ditch

(5)Air Vent
Insect Screen

(6)Manhole

(7)Water Level Indicator

Layout of House connection



PART II
Inspeksi Proyek Air Minum di Pedesaan

Lesson 6 Construction Inspection

- Apa itu inspeksi konstruksi?
- prosedur pemeriksaan
- pemeriksaan poin

1. Apa itu Inspeksi Konstruksi ?

Ya atau Tidak, Semuanya atau Tidak sama sekali

Diskusi

Apa yang / diperlukan untuk menjamin kualitas infrastruktur yang baik?

Kemamapuan kontraktor untuk konstruksi

Kemampuan Perusahaan Konstruksi

atau

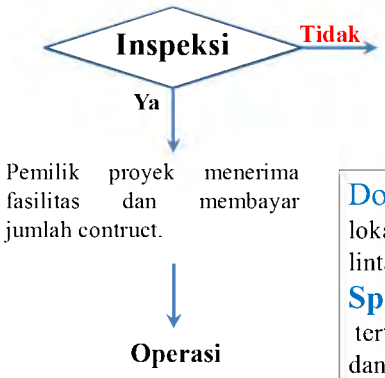
Supervision

atau

Inspeksi

Inspeksi adalah

Untuk memastikan bahwa pekerjaan Kontraktor dilakukan sesuai dengan dokumen kontrak dan spesifikasi proyek.



Untuk menginformasikan kontraktor
Kontraktor harus memperbaiki pekerjaan yang tidak dapat diterima Pembayaran postphoned.

Dokumen Kontrak (gambar)
lokasi, aspek fisik, dimensi pekerjaan, layout, profil, lintas-bagian, dan rincian lainnya.

Spesifikasi
tertulis arah teknis dan persyaratan untuk pekerjaan, dan memberikan instruksi yang tidak secara khusus ditunjukkan pada gambar.

Konstruksi Inspektur/pemeriksaan Job Description

Secara umum personel inspeksi harus memastikan item berikut:

a. Semua material dan pengerjaan sesuai dengan spesifikasi dan praktik yang baik diterima.
b. Pengujian kualitas kontrol yang berada pada tingkat bahan yang dapat diterima pengerjaan.
c. Semua pekerjaan harus sesuai dengan tingkat, keselarasan, dimensi, dan lintas-bagian sebagaimana ditentukan dalam gambar konstruksi dan spesifikasi.

2. Prosedur Inspeksi

Pre-Inspeksi

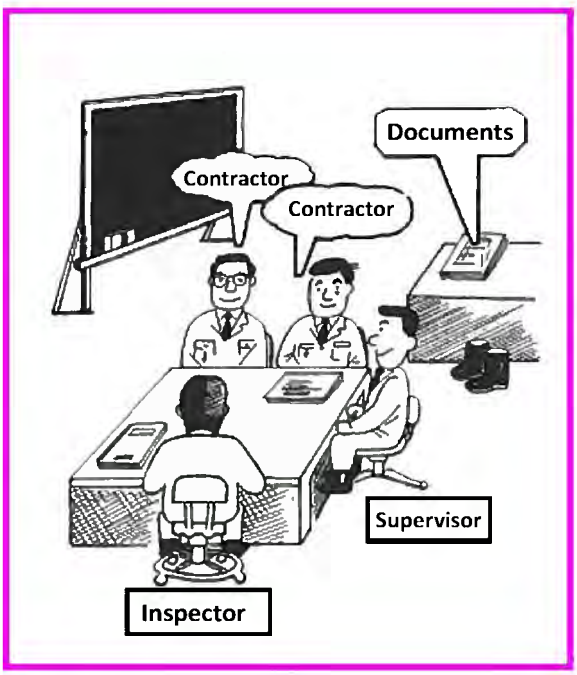
1. Untuk menerima semua rencana, gambar disetujui, spesifikasi, dan dokumen lain yang berkaitan dengan proyek yang ditugaskan.

Awal Inspeksi

2. Untuk menjelaskan tentang garis besar pekerjaan konstruksi keseluruhan dan berbagai pemeriksaan dengan menggunakan gambar dan BOQ oleh Kontraktor.

Inspeksi

3. Untuk memulai pemeriksaan lapangan atau pemeriksaan dokumen.



Pada awal Inspeksi

a. Penjelasan Pekerjaan Konstruksi oleh Kontraktor
   - Gambar
   - BOQ
   - Spesifikasi Teknik

b. Penjelasan tentang berbagai Inspeksi dengan
   - Gambar
   - BOQ

Lokasi Inspeksi

Inspesi Document

2-1. Lokasi Inspeksi

Inspeksi Menengah dan inspeksi Penyelesaian

(1) Untuk mengukur dimensi fasilitas, dan periksa apakah pengukuran bertemu dengan gambar-gambar.
(2) Untuk memeriksa materi tentang jumlah dan kualitas.
- Pemeriksaan di lokasi mengenai bahan
- Jumlah perhitungan di lokasi
- Jaminan dokumen dan pemeriksaan kualitas
- Laporan pengiriman

(3) Untuk memeriksa penampilan eksternal dengan melihat/memandang
- Pengerjaan/ pekerja
- Situasi di bawah Konstruksi

2-2. Inspeksi Dokumen

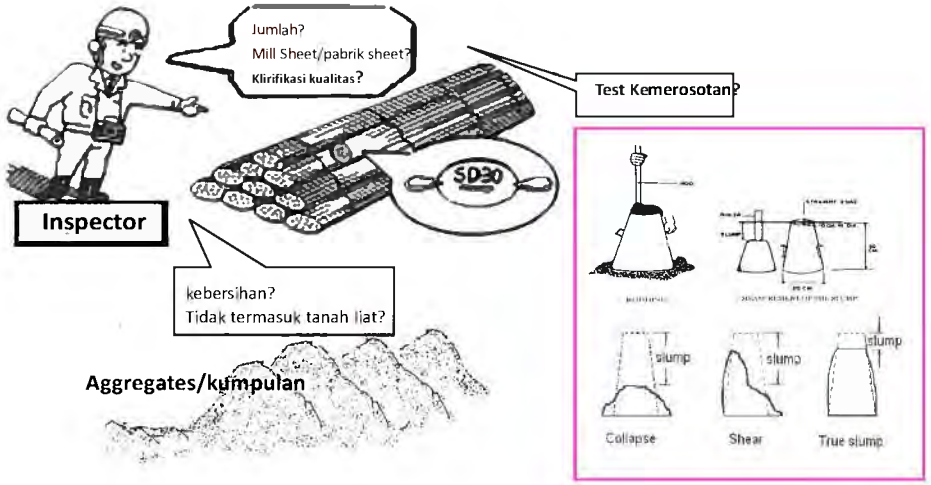
(1 Konfirmasi Dokumen disampaikan
1) Dokumen Kontrak: nilai kontrak dan kondisi pembayaran
2) Kuantitas menunjukkan harga satuan dan jumlah
3) Uraian mengenai perubahan, perubahan atau variasi, jika ada
4) Laporan Pemeriksaan lokasi oleh KDD
5) Digital data BOQ
(2) Konfirmasi Persyaratan pembayaran
(3) Perhitungan dalam lembaran penagihan
(4) Konfirmasi selesai bekerja di BOQ, gambar dan foto
(5) Konfirmasi jadwal kerja
(6) Konfirmasi hasil pemeriksaan oleh KDD

3. Pemeriksaan terhadap Poin

1. Pememeriksaan bahan
2. Proses pememeriksan
3. Mengukur dimensi fasilitas
4. pememeriksan penampilan eksternal
5 . Pememeriksaan terhadap BOQ
6. Memeriksa foto-foto konstruksi
7. Contoh mengenai cek poin

3-1. Pengecekan terhadap Bahan-bahan

Untuk memeriksa materi tentang jumlah dan kualitas.



PEDOMAN DALAM MEMPRODUKSI BETON YANG BAIK

1. Menggunakan Bahan Kanan
   - Semen Portland
   - Agregat (Kerikil & Pasir)
   - Air
   - admixtures
2. Mendapatkan Proporsi Right Mix
3. Mengontrol Proporsi dan Mixing Metode
   - Sebuah campuran homogen
   - Batch Seragam
4. penempatan
5. pengobatan
   - Untuk mencegah baru menuangkan beton dari pengeringan keluar terlalu cepat

INSPEKSI BETON

Inspektur tentu harus mengacu pada gambar desain dan spesifikasi, untuk memastikan bahwa ini dipenuhi, dan untuk menyimpan catatan yang meliputi sebagai berikut:
1. Kualitas dan proporsi bahan beton dan kekuatan beton;
2. Konstruksi dan penghapusan bentuk dan menopang;
3. Menempatkan bala bantuan;
4. Pencampuran, menempatkan dan menyembuhkan beton;
5. Urutan pemasangan dan penyambungan dinding, dan
6. Kemajuan umum pekerjaan.

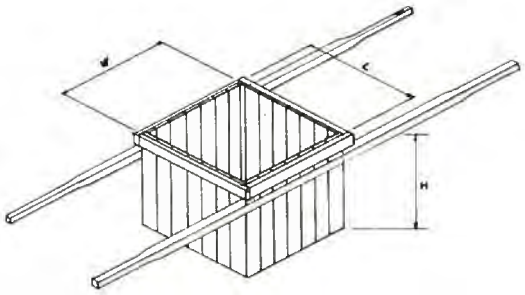
Fine Aggregates or Sand - Removing Clay and Silt -

Tanah liat dan lumpur muncul dalam jumlah yang berlebihan dapat dideteksi dengan melakukan tes berikut:

1. Isi botol liter (1,14 liter) atau labu Erlenmeyer dengan pasir hingga kedalaman 5,0 cm (2 inci);
2. Penambahan air sampai toples atau termos adalah 3/4 penuh;
3. Kocok isi selama sekitar satu menit dengan beberapa terakhir getar dalam menyamping arah;
4. Biarkan jar untuk berdiri selama 30 menit;
5. Amati atas pasir. Jika ada lebih dari 3,2 mm lapisan sedimen, pasir di mana sampel diambil tidak cocok untuk tujuan konstruksi. Namun, agregat tersebut dapat digunakan setelah mencuci dan menghapus materi yang tidak diinginkan

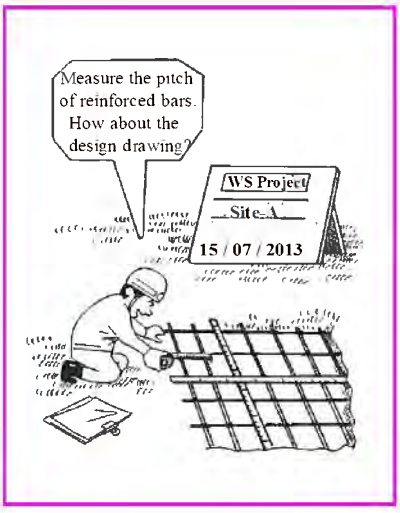
Typical concrete mixes and their uses

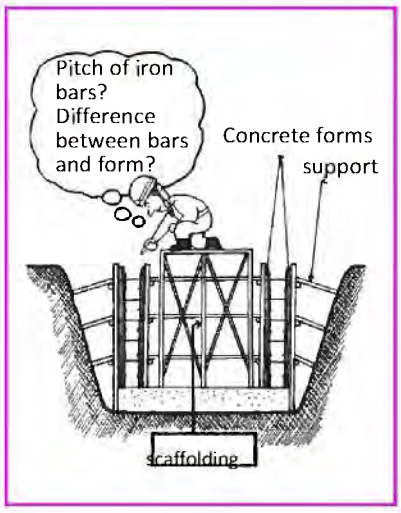
Class	Typical Concrete Mixes (volume proportions)				Quantity of Materials per m^3 of Concrete				Usage
	Cement	Water	Sand	Gravel	Cement		Sand	Gravel	
					bags	m^3	m^3	m^3	
AA	1	0.7 – 1.0	1.5	3.0	10.4	0.294	0.44	0.88	Foundation
A	1	0.7 – 1.0	2.0	4.0	7.9	0.223	0.45	0.9	Beams & Slabs
B	1	0.7 – 1.0	2.5	5.0	6.5	0.184	0.46	0.92	Columns
C	1	0.7 – 1.0	3.0	6.0	5.5	0.156	0.47	0.94	Flooring on fill, and pavements
D	1	0.7 – 1.0	3.5	7.0	4.8	0.136	0.48	0.96	Big Mass Footings



Capacity (m^3)	Inside Measurements		
	Length (m)	Width (m)	Height (m)
0.10	0.4	0.4	0.63
0.20	0.6	0.6	0.56
0.30	0.8	0.8	0.47

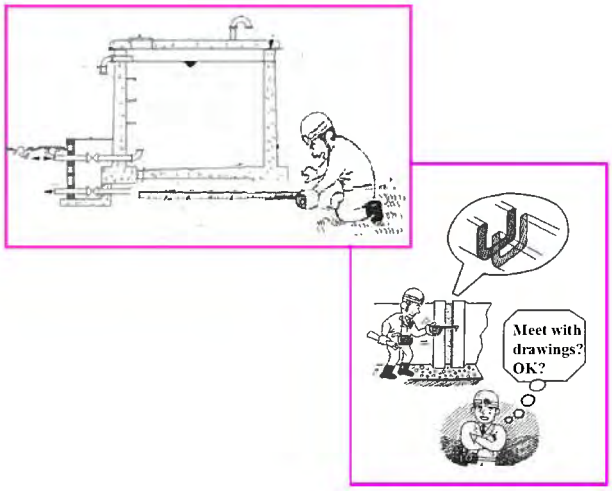
3-2. To check the Processes





3-3. Untuk mengukur fasilitas dimensi

Untuk mengukur dimensi fasilitas, dan perlu periksa apakah pengukuran tersebut selaras dengan gambar.



3-4. Pemeriksaan penampilan eksternal

Cold Joints/sendi dingin

Nobuaki Otsuki, Junji Yokokura dan Takahiro Nishida
Tingkat Teknologi Realisasi Beton di Negara Berkembang
- Masalah Beton di Dunia

Contoh yang kuran baik

Melacak Bubble(meruap)

Lackof corner/kekurangan sudut

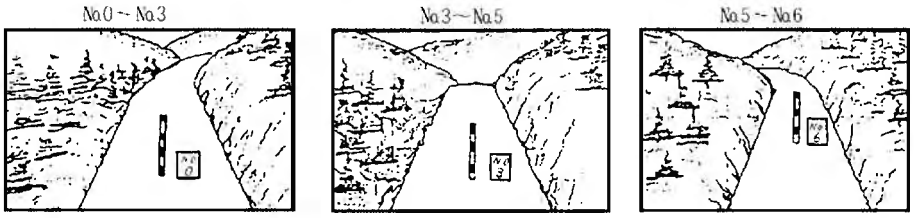
3-5. Pengecekan mengenai BOQ

Item	Shape/ Spec.	unit	Quantity			Remarks
			Contract	Execution	Execution Rate (%)	
Pipe Laying	D 50 mm	m	1,500	1,350		
Concrete Tank	2 x3 x2.5		1	1		RC
Excavation	0.4 x 0.3	m3	180	162		0.12m3/m

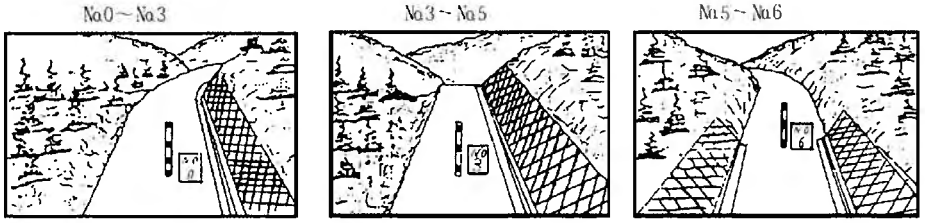
3-6. Pemeriksaan mengenai foto-foto konstruksi

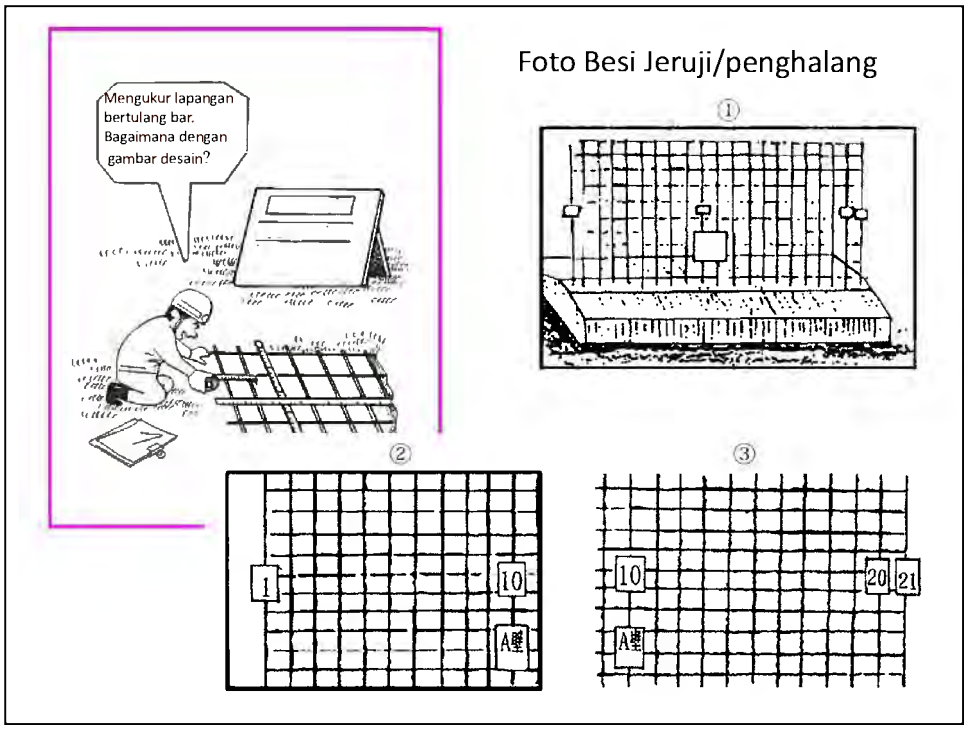
1. Penyelesaian Foto foto pra-konstruksi
2. Foto di bawah-membangun (metode bangunan)
3. Foto menggunakan bahan
4. Foto kualitas material (bahan pengujian)
5. Foto fasilitas dimensi Foto

Pre-Construksi



Post/paska-Construksi




Mengukur lapangan bertulang bar. Bagaimana dengan gambar desain?
Foto Besi Jeruji/penghalang
①
②
③
1
10
A壁
10
20
21
A壁

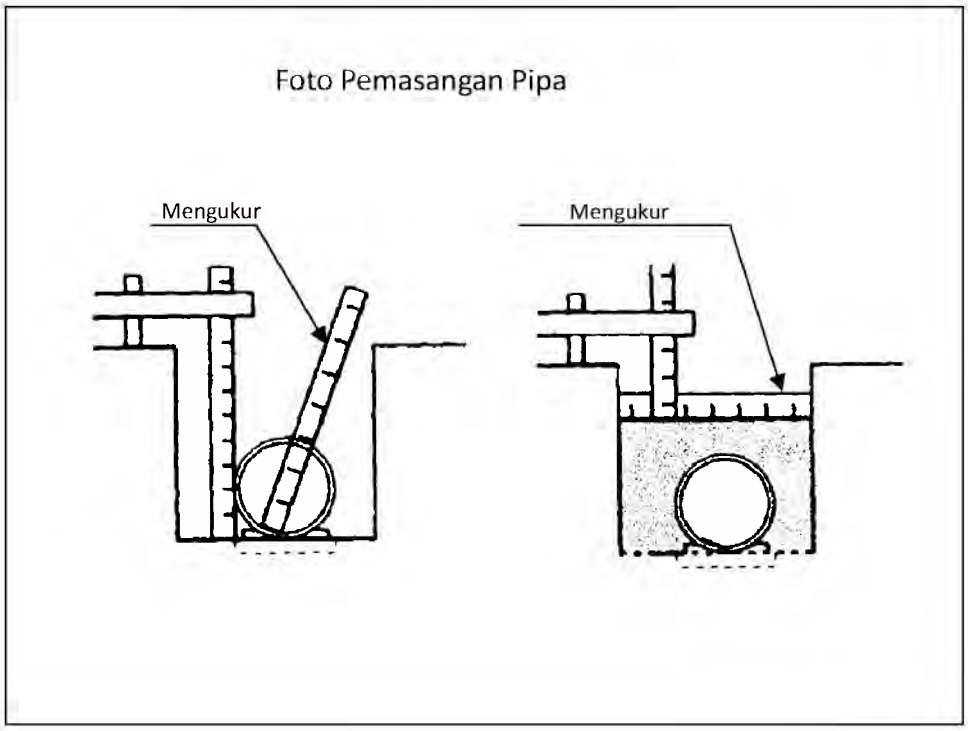
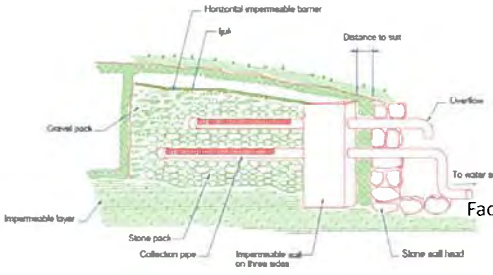


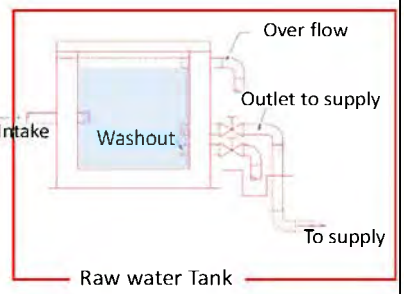
Foto Pemasangan Pipa
Mengukur
Mengukur

3-7. Examples of check points

Fasilitas Intake dan Sumber Air

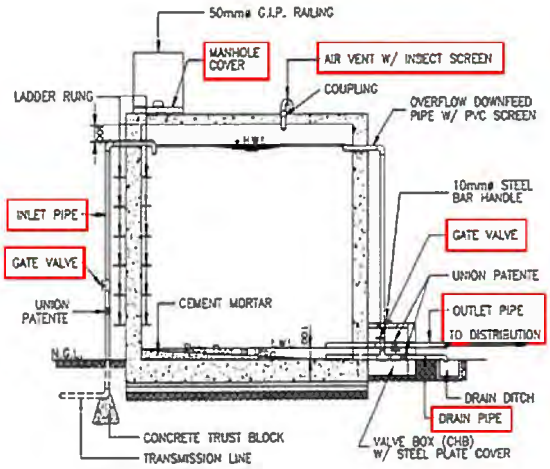
1. Kuantitas air dari sumber
2. Kualitas air dari sumber
3. Jumlah air yang disediakan





To built a raw water tank/Untuk membangun sebuah tangki air baku.

Reinforced Concrete Reservoir



GROUND LEVEL RESERVOIR
(CONCRETE)

(1) Inlet Pipe & Valve

(2) Outlet Pipe & Valve

(3) Overflow Pipe

(4) Drain Pipe & Valve

(5) Air Vent

(6) Manhole

(7) Water Level Indicator

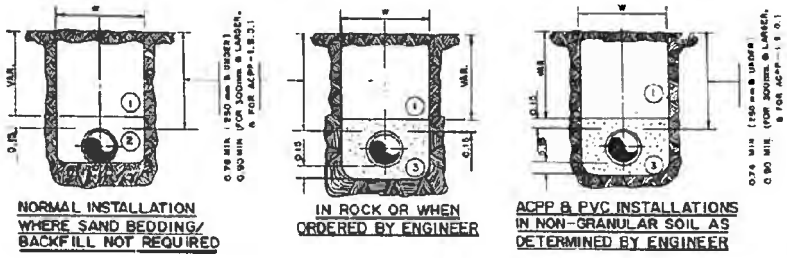
No valve on the inlet pipe/Tidak ada katup pada pipa inlet..

No valve on the outlet pipe/Tidak ada katup pada pipa outlet.

Points of Pipeline Inspection

1. Bahan-Bahan
2. Panjang dan Diameter
3. Penggalian dan Pemasangan Pipa
4. Profil Pipeline
5. Perlengkapannya untuk Pipeline
6. Blok dorong dan Jangkar

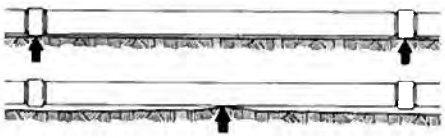
Penggalian dan Pemasangan Pipa



① dipadatkan pengurukan bahan asli yang dipilih.
② dipadatkan bahan asli dipilih dalam 0,15 m lapisan.
③ Disetujui seprai pasir & pengurukan tangan ditempatkan & dipadatkan.

Benar

Salah

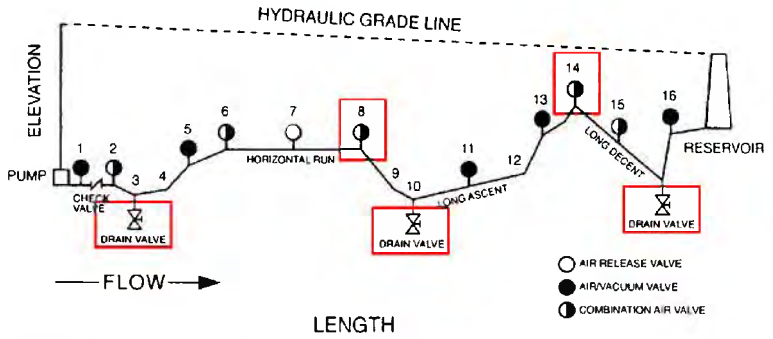


Koneksi Pipa yang salah dan Lentur

Untuk membuat jalur utama yang jelas yang merupakan cabang.

Untuk menggunakan gabungan tikungan(**22½**).

Sample Pipeline Profile Illustrating Valve Locations



NO.	DESCRIPTION	RECOMMENDED TYPES
1	Pump Discharge	Air/Vacuum for Pumps
2	Incr. Downslope	Combination
3	Low Point	No Valve Required
4	Increase Upslope	No Valve Required
5	Decrease Upslope	Air/Vac or Combination
6	Beginning Horizontal	Combination
7	Horizontal	Air/Rel or Combination
8	End Horizontal	Combination
9	Decrease Downslope	No Valve Required
10	Low Point	No Valve Required
11	Long Ascent	Air/Vac or Combination
12	Increase Upslope	No Valve Required
13	Decrease Upslope	Air/Vac or Combination
14	High Point	Combination
15	Long Descent	Air Release or Combination
16	Decrease Upslope	Air/Vac or Combination

Lokasi Air Valve Seiring dengan sebuahPipeline

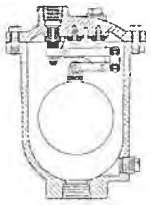
Katup udara dipasang pada pipa untuk pembuangan udara dan mengakui untuk mencegah kondisi vakum dan udara terkait lonjakan. The AWWA Steel Pipe manual merekomendasikan Air Katup pada titik-titik berikut sepanjang jalur pipa.

1. Poin tinggi: Kombinasi Valve Air
2. Berjalan Horizontal Panjang: Rilis Air atau Kombinasi Valve pada 380 interval 760 m.
3. Descents Panjang: Kombinasi Valve pada 380 interval 760 m.
4. Ascents Panjang: Air / Vacuum Valve pada 380 interval 760 m.
5. Penurunan di Lereng Up: Air / Vacuum Valve
6. Kenaikan di Lereng Bawah: Kombinasi Valve Air

From "Theory, Application, and Sizing of Air Valves" (Val-Matic Valve and Manufacturing Corporation)

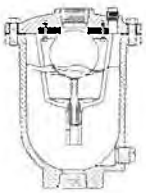
Air Rilis Katup

Katup ini memiliki lubang kecil presisi untuk melepaskan udara di bawah tekanan terus-menerus selama beroperasi dalam pipa.


AIR RELEASE VALVE

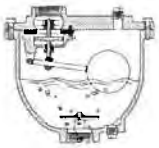
Air / Vacuum Katup

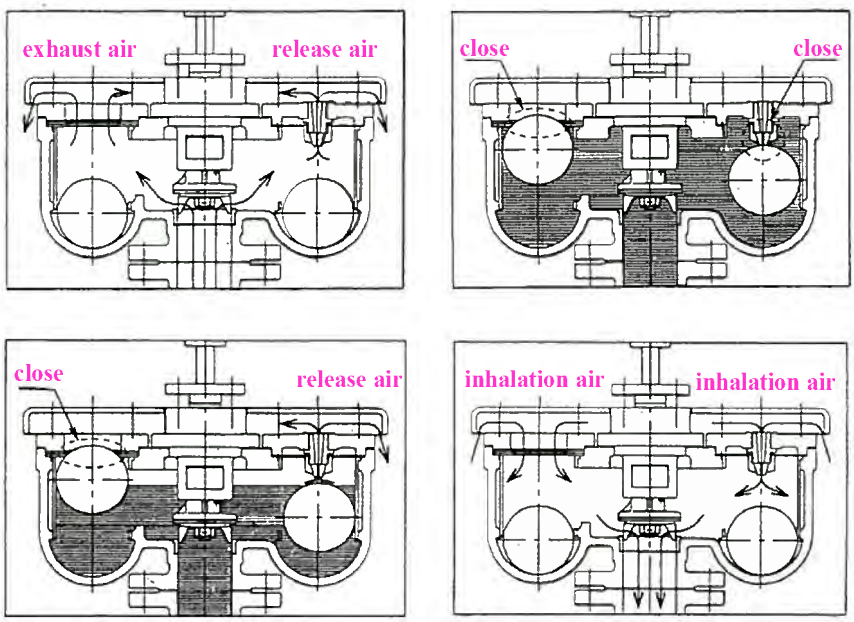
Udara / Vacuum Katup dipasang hilir pompa dan pada titik-titik tinggi untuk knalpot volume besar udara selama pompa start-up dan mengisi pipa. Katup juga akan mengakui volume besar udara untuk mencegah kondisi vakum dari terjadi di dalam pipa dan memungkinkan untuk pengeringan.


AIR/VACUUM VALVE

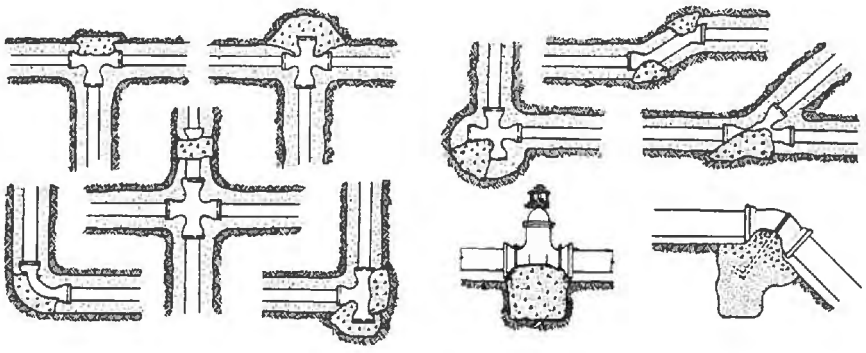
Kombinasi Air Valves

Kombinasi Valve Air menggabungkan fungsi kedua Udara / Vacuum dan Katup Rilis Air dan merupakan pilihan yang sangat baik untuk poin tinggi. Sebuah Valve Kombinasi mengandung kedua lubang pelepasan kecil dan pelabuhan udara / vakum besar dalam satu perakitan


SINGLE BODY COMBINATION



Thrust Blocks & Anchors



THRUST BLOCKS and ANCHORS

添付資料 20 ケーススタディ(給水)(英語版)

Design of Rural water supply : Case Study (1)

1. Service Area and Water Demand
2. Water Source
3. Transmission Main
4. Reservoir (Tank)
5. Distribution Main
6. Stand Pipe

PDID	CHECKLIST C-3-1 (1/4)			Verified by	Approved by
Type of Project	Water Supply – spring/river bed water	Objective	Planning and Design		

Contract/Project No.		Date of Submission	/ , 201 (dd / mm , yyyy)
Project Name		Stage	Verification of Draft Contract Documents
Implementing Agency			

Check Item	Check Point	Date Checked	Tick	Remarks
Project concept	Is the project proposed in accordance with Government Strategy (rural and urban water supply development strategy)?			
Coordination	Was all coordination made between the relevant agencies?			
Project area	Are data/information available, including: ☐ number of present population and households, ☐ major income sources, ☐ development history of the villages/towns, ☐ rainfalls?			
	Are the area frequently affected by natural disaster like ☐ floods or ☐ landslides?			
Project target	Target year: _____			
	Number of households to be served: _____			

PDID	CHECKLIST C-3-1 (2/4)			Verified by	Approved by
Type of Project	Water Supply – spring/river bed water	Objective	Planning and Design		

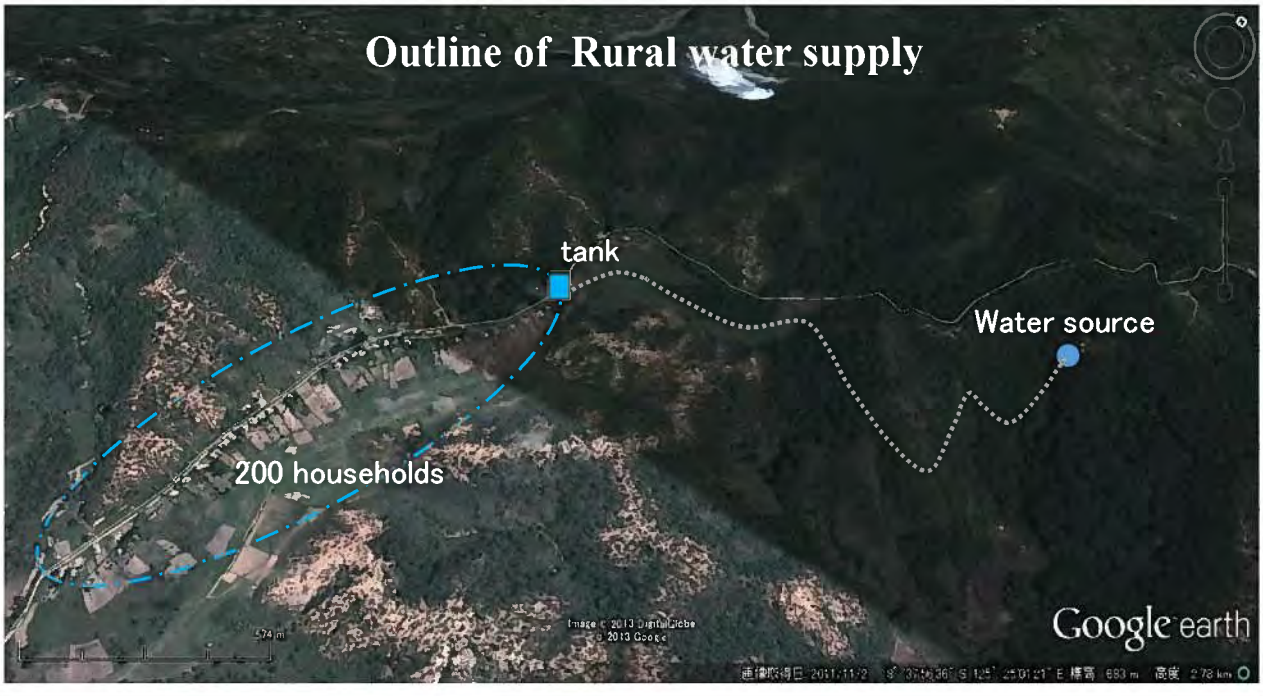
Check Item	Check Point	Date Checked	Tick	Remarks
Existing condition	Are data are available on:			
	☐ What are the present water sources for people's daily lives?			
	☐ What are their major problems (☐quantity, ☐quality, ☐distance)?			
	☐ What are health condition of the people? (morbidity rate of water borne diseases)			
Planned water source	Is water source sufficient in quantity and quality? Quantity: _____ L/sec, Quality: ☐ turbid, ☐ not turbid			See Annex: Planned water source No.1
	Is its yield stable throughout the year? ☐ yes, ☐ no			
	Is gravity flow system applied for water transmission? ☐ yes, ☐ no			
	Is catchment area of the source sufficient? ☐ yes, ☐ no			See Annex: Planned water source No.4
Future water demand	Supply water to the people via ☐ house taps or ☐ public taps?			
	Design value of unit water consumption per capita per day: _____L/c/d			
	Is calculation for future water demand by the service population made or not? ☐ yes, ☐ no			

PDID	CHECKLIST C-3-1 (3/4)			Verified by	Approved by
Type of Project	Water Supply – spring/river bed water	Objective	Planning and Design		

Check Item	Check Point	Date Checked	Tick	Remarks
Pipeline design	Is pipe diameter estimated using pipe-flow formula with variables of distance, height and flow rate? ☐ yes, ☐ no			See Annex: Pipeline design No.1
	Are drawings of hydrauhc profile based on field survey attached? ☐ yes, ☐ no			See Annex: Pipeline design No.2
	Are pipe accessories such as gate valves, air valves, wash-outs properly designed? ☐ yes, ☐ no			See Annex: Pipeline design No.3
Service reservoir design	Is the reservoir equipped with ☐ inlet valves, ☐ outlet valves, ☐ drain pipes, ☐ overflow pipes, ☐ air ventilator.			See Annex: Service reservoir design No.1
	Is concrete structure with reinforcement bars normally designed: ☐ yes, ☐ no			
Public taps	Number of faucets equipped at a tap: ___ faucets			
	Number of households to be served by one tap: _____ households			
	Are concrete apron properly designed: ☐ yes, ☐ no			
	Are drain pipes equipped at the concrete apron: ☐ yes, ☐ no			

PDID	CHECKLIST C-3-1 (4/4)			Verified by	Approved by
Type of Project	Water Supply – spring/river bed water	Objective	Planning and Design		

Check Item	Check Point	Date Checked	Tick	Remarks
Operation & maintenance after construction	Is water user committee planned to organize in the village/town: ☐ yes, ☐ no			
	Is an operation plan (cleaning, valve control, etc.) prepared: ☐ yes, ☐ no			
	Will fixed amount of fees for O&M be collected from the households: US$_____ /month/household			
People's awareness	Do people have an awareness to pay for O&M fees: ☐ yes, ☐ no			
	Do people have a willingness to be serviced: _____ households out of _____ households			



1. Service Area and Water Demand

(1) Service Area

(2) Water Demand

Households (HHs) = 200, average 1 HH = 6 persons
Total served Population = 200 x 6 = 1,200 persons
Average Water demand = 1,200 x [a] lpcd = [b] l/d

NRW (Leakage ratio) = 15 %
Distributed amount including Leakage
= [b] l/d / (1 – 0.15) / 86400 sec/d = [c] l/sec

Maximum Water demand
= Average Water demand (including NRW) x 1.30
= [c] l/sec x 1.30 = [d] l/sec

quote from Multi-Village Pooling Project in Indonesia
Handbook for Community-Based Water Supply Organizations

2. Water Source

Flow Measurement Using Volumetric Method

Volumetric Method: Suitable for point source flows, i.e. the flow of water localized

You will need : 1. Water container with a known volume
2. Stop watch
3. Pen and paper to note down the results

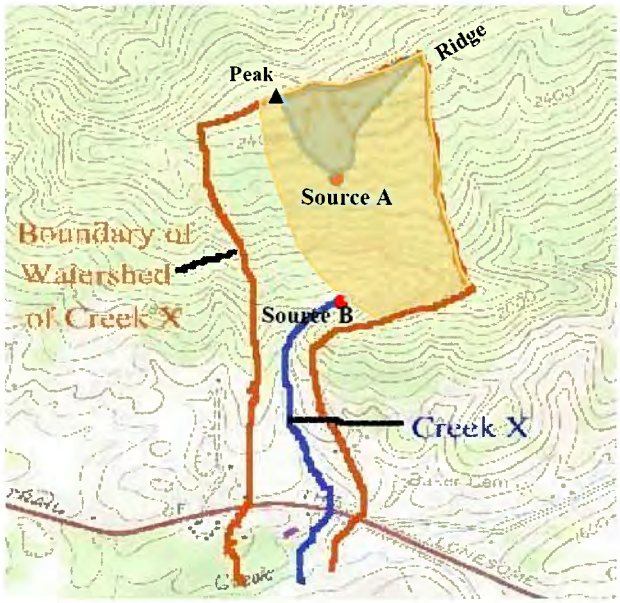
Water Source = 1.5 L/sec

Steps 1. Place the container at the point of fl ow
2. Record the time it takes to fi ll up
3. Repeat a few times for best results
4. Calculate the Quantity of Flow with the formula below for each trial
5. Take the average Quantity of Flow for all trials

Formula Q = V / T

Q : quantity of flow
V : volume of container (in liters)
T : time it takes to fill up the container (in seconds)

(Catchment Area)

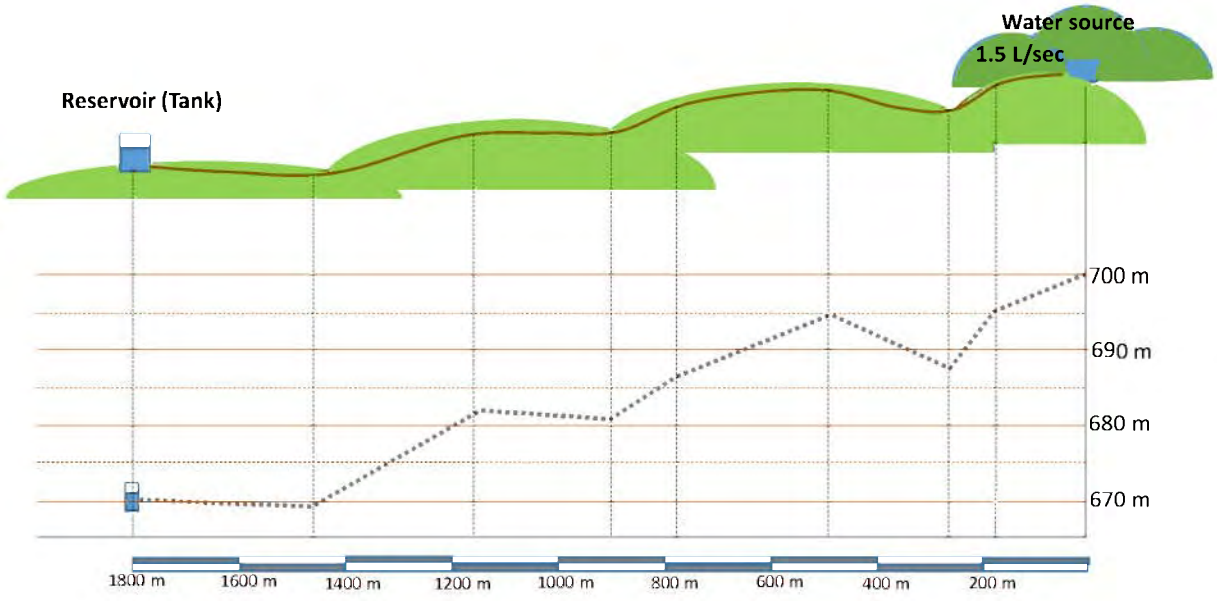


Catchment Area

Source A:

Source B:

3. Transmission Main



4. Reservoir (Tank)

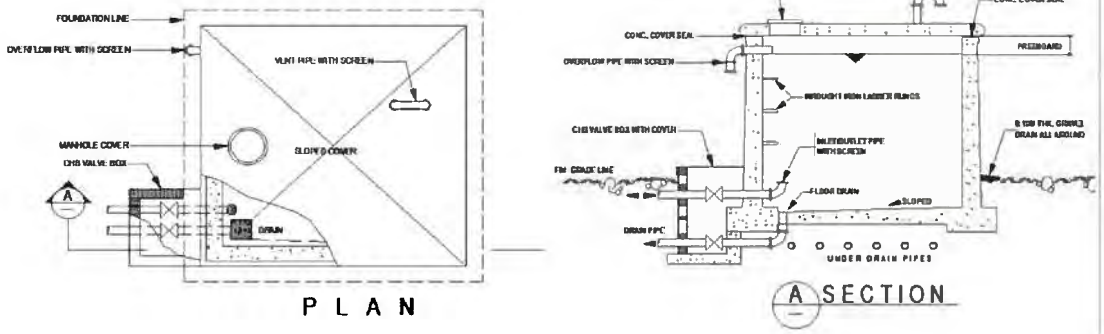
Capacity

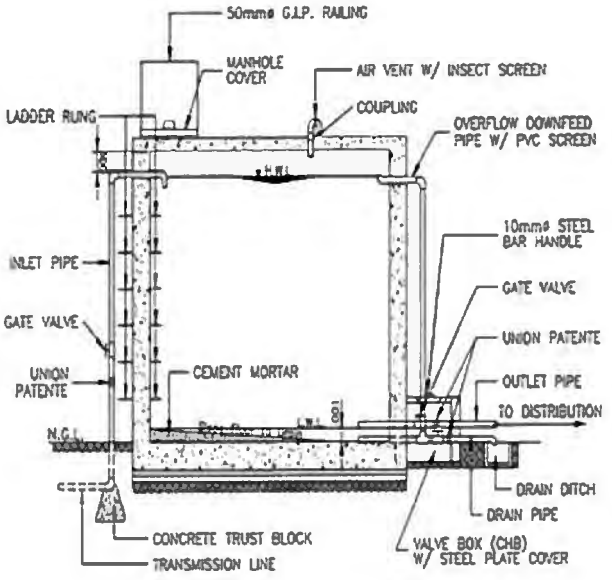
Cr = (1/4) (ADD)

where:

Cr = Reservoir capacity in liters

ADD = Average day demand in liters per day





(1)Inlet Pipe
Gate Valve

(2)Outlet Pipe
Gate Valve

(3)Overflow Pipe
Connect to drain pipe

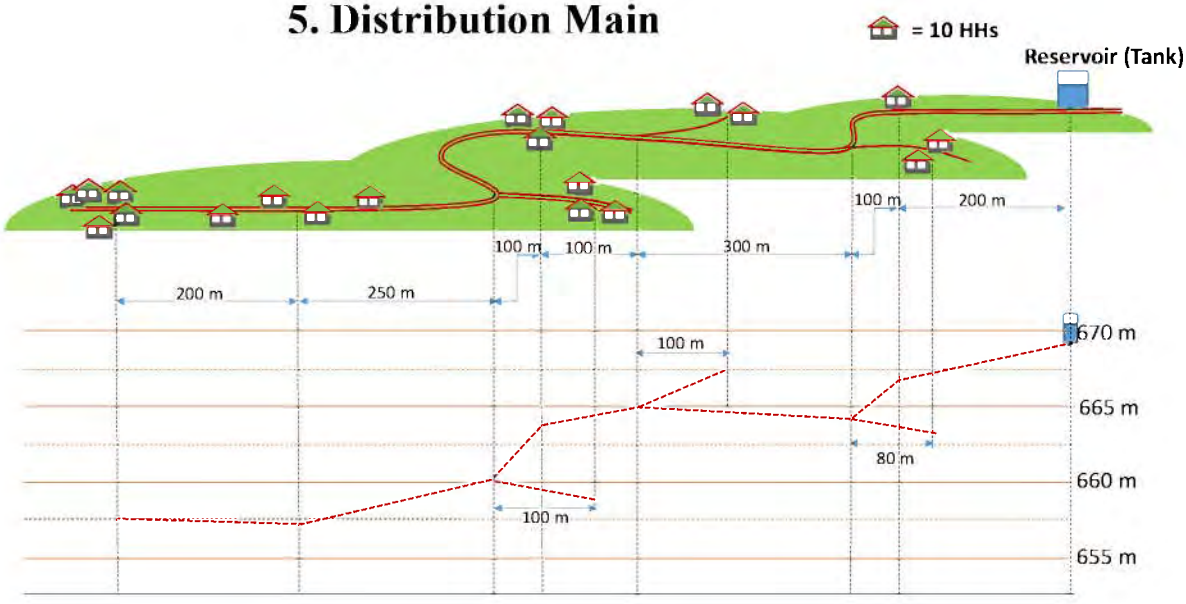
(4)Drain Pipe
Gate Valve, Drain Ditch

(5)Air Vent
Insect Screen

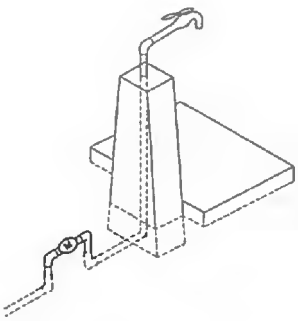
(6)Manhole

(7)Water Level Indicator

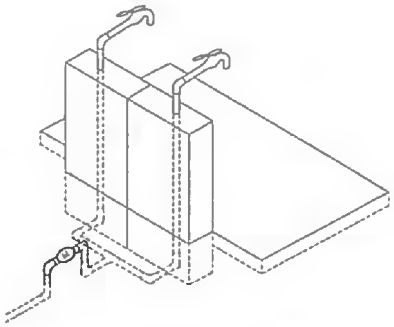
5. Distribution Main



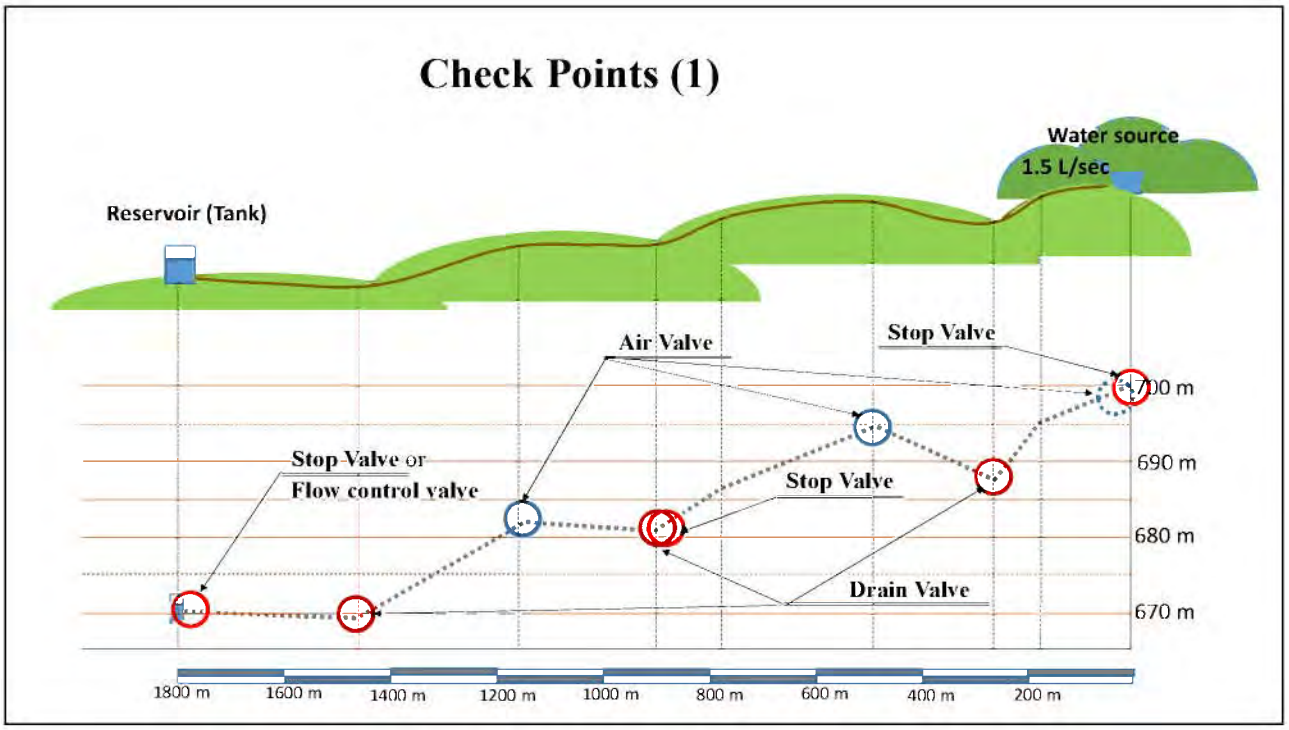
6. Stand Pipe

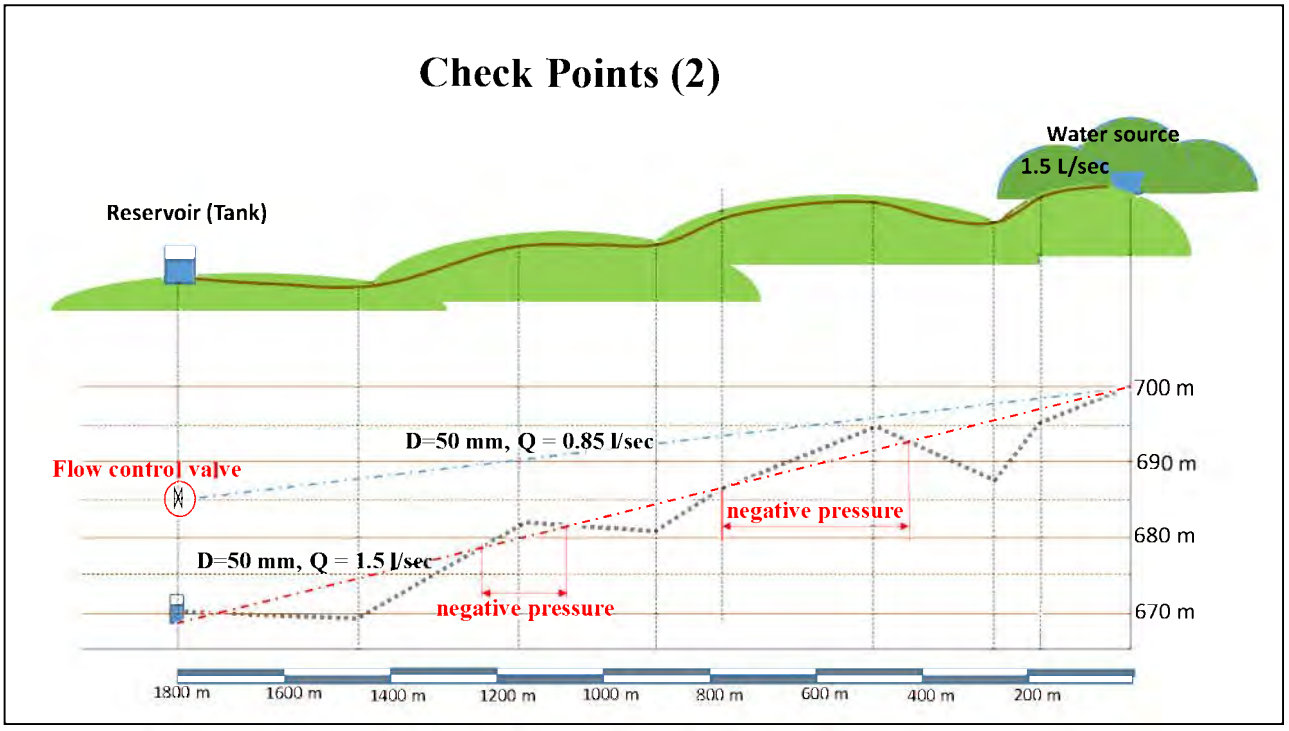


PUBLIC FAUCET INSTALLATION
SINGLE TYPE FAUCET



PUBLIC FAUCET INSTALLATION
DOUBLE TYPE FAUCET


Check Points (1)
Water source
1.5 L/sec
Reservoir (Tank)
Air Valve
Stop Valve
Stop Valve or
Flow control valve
Stop Valve
Drain Valve
700 m
690 m
680 m
670 m
1800 m
1600 m
1400 m
1200 m
1000 m
800 m
600 m
400 m
200 m

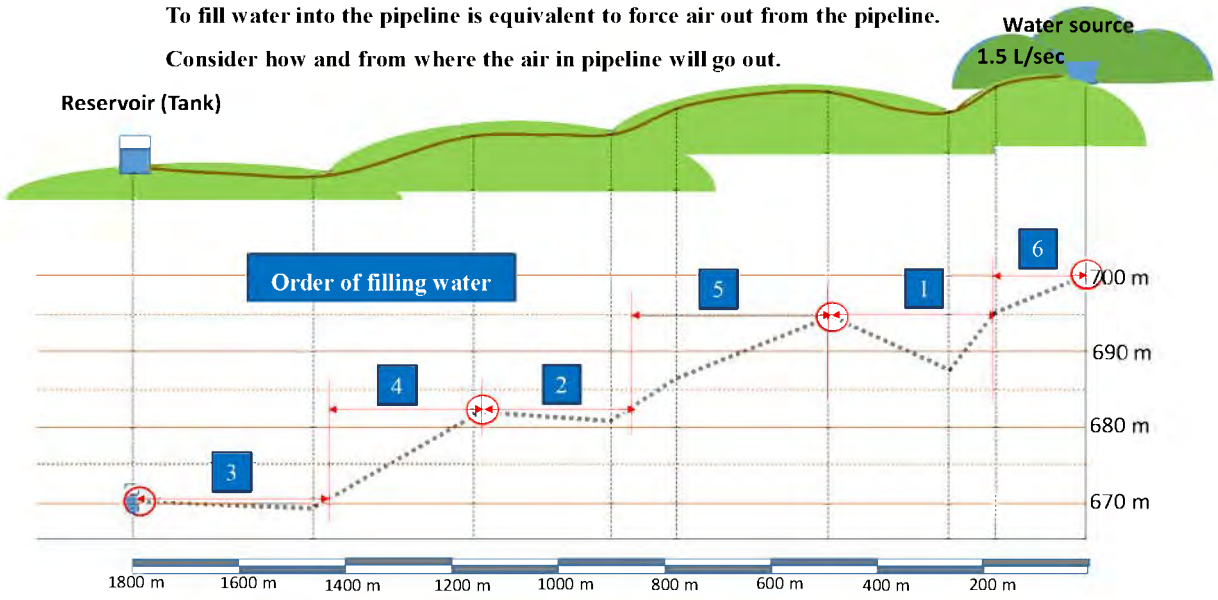

Check Points (2)
Water source
1.5 L/sec
Reservoir (Tank)
D=50 mm, Q = 0.85 l/sec
Flow control valve
negative pressure
D=50 mm, Q = 1.5 l/sec
negative pressure
700 m
690 m
680 m
670 m
1800 m
1600 m
1400 m
1200 m
1000 m
800 m
600 m
400 m
200 m

Knowhow: filling of water

How to fill water into the pipeline after construction

To fill water into the pipeline is equivalent to force air out from the pipeline.

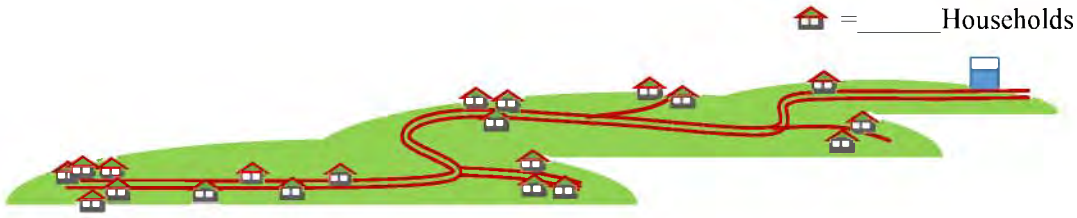
Consider how and from where the air in pipeline will go out.



WORKSHEET : **Design of Rural Water Supply - Case Study (1) –**

1. Project area

Number of present population and households



Present population = _____ HHs x _____ Persons/HH

HH: Household

2. Project target

Target year: _____

Number of households to be served: _____

Number of population to be served: _____

3. Planned water source

a. Is water source sufficient in quantity and quality?

a-1. Quantity: _____ L/sec

a-2. Quality : □ turbid, □ not turbid

b. Is its yield stable throughout the year? □ yes, □ no

c. Is its yield stable throughout the year? □ yes, □ no

d. Catchment area of the source: _____ m length x _____ m width

4. Future water demand

a. How to supply water to the people

□ house connection □ public taps

b. Design value of unit water consumption per capita per day: _____L/c/d

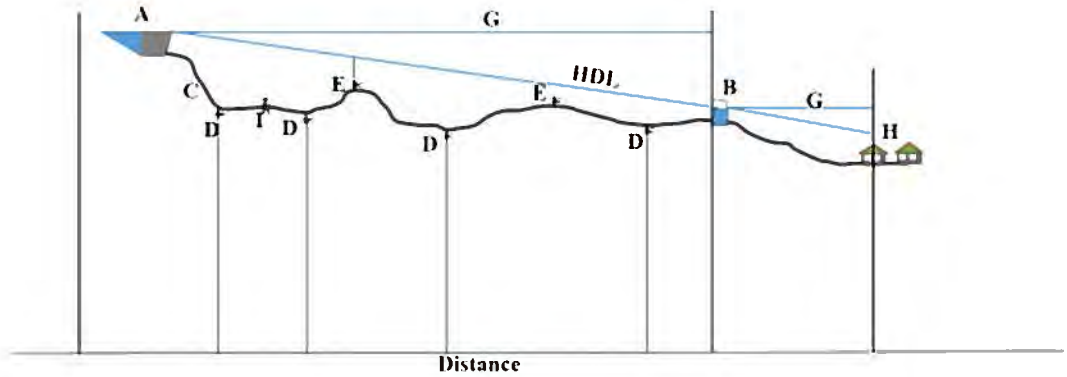
c. Is calculation for future water demand by the service population made or not?

□ yes, □ no

5. Pipeline design

a. Are pipe accessories such as gate valves, air valves, wash-outs properly designed?

□ yes, □ no



A = Intake structure
B = Storage reservoir
C = Pipeline
D = Blow-off valve
E = Air valve

HDL = Hydraulic grade line
G = Static head
H = Rural town or Village
I = Sectioning valve (every 1.5 km)

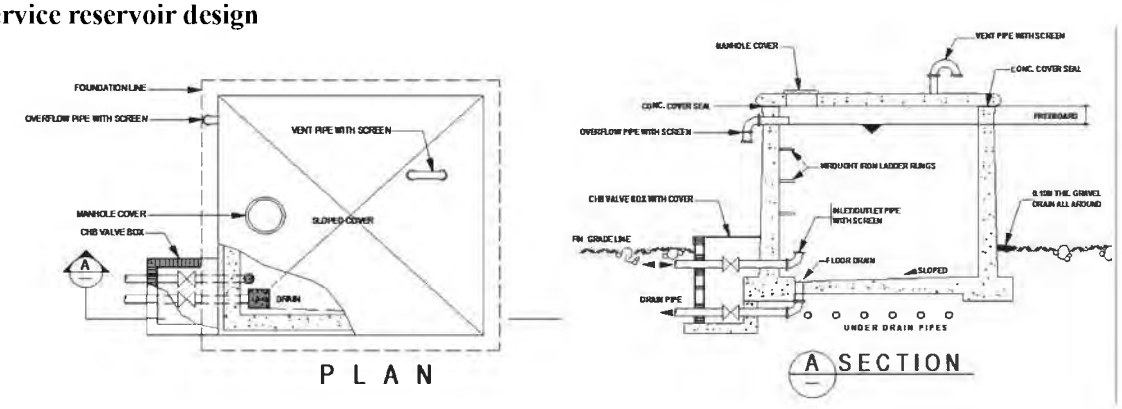
b. Are drawings of pipe-laying attached?

□ yes, □ no

c. Are hydraulic grade (water heads) calculated? (example: calculated by EPANET)

□ yes, □ no

6. Service reservoir design



a. Is the capacity of reservoir sufficient? _____ m^3

Cr = (1/4) (ADD)

where:

Cr = Reservoir capacity in liters

ADD = Average day demand in liters per day

b. Is the reservoir equipped with

□ inlet valves, □ outlet valves, □ drain pipes, □ overflow pipes,

□ air ventilator.

c. Is concrete structure with reinforcement bars normally designed:

□ yes, □ no

7. Public taps

a. Number of faucets equipped at a public stand: ____ faucets

b. Number of households to be served by a public stand: _____ households

c. Are concrete apron properly designed:

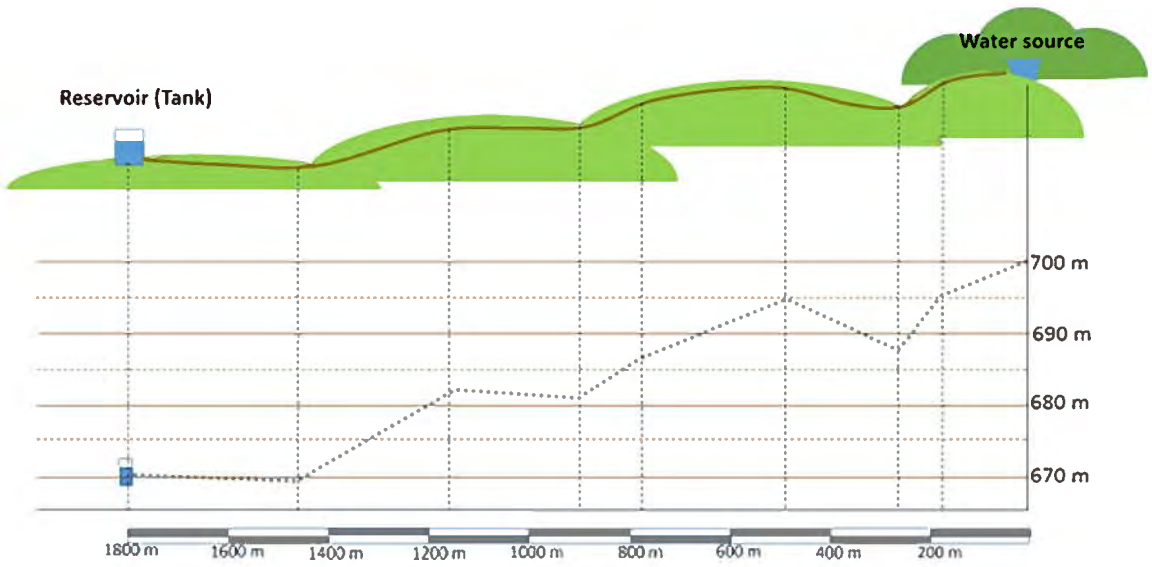
□ yes, □ no

d. Are drain pipes equipped at the concrete apron:

□ yes, □ no

Hydraulic calculation

1. Transmission pipe



2. Distribution Pipes